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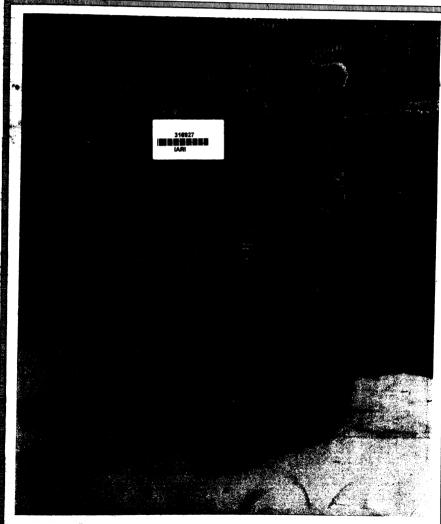
SIXTY-SEVENTH YEAR SIXTY-SEVENTH YEAR B B A R CIENTIFIC ANER CAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

OLUME CIV.

NEW YORK, JANUARY 7, 1911

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"WAN." HE IS FROM ALASKA AND IS ONE OF THE BIGGEST BROWN BEARS IN CAPTIVITY

Photograph by Walter L. Remier

See page 11

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The purpose of this journal is to record accu-itely, simply, and interestingly, the world's rogress in scientific knowledge and industrial

High Speed Through the Ice Fields

THE Board of Trade inquiry into the loss of the "Titanio," which is being held under Lord Mersey, naturally is eliciting more detailed evidence than it was possible to gather during the necessarily limited investigation by our Senate Committee. Thus far, some very startling testimony has been given (startling at least to the lay mind) by certain of the cutartung at ceast to the say much my everain of the more important witnesses. Mr. Ismay, for instance, gave an unqualified endorsement of the course followed by Capt. Smith, of the "Titanio," in proceeding at full speed after he had received several warnings that there was heavy ice ahead of the ship. The witness nade the point that, by traveling at high speed, the 'Titanic' would have been sooner through the zone of danger and out in clear water again. The argument is familiar. We have heard the same thing said in justification of traveling at high speed through a belt of

So important is this testimony in the light which it So important is this testimony in the light which it is throw on the risks of transstantic travel, that we have made personal unquiry among the navigating officers of several first-class passenger ships, and we find that if the weather is clear, it is the univorsal practice not to slow down the ship, even though it be well known, through wireless despatches, that there is a field of ice aboad. "We never stop for ice in clear weather," said one officer of an English ship. "The course followed by Capt. Smith was perfectly justified,"
was the comment of the leading officer on one of the was the comment of the leading officer of one of the fastest German slips. Indeed, the consensus of this expert opinion, without an exception, justified the high speed of the "Titanic," as being in accordance with the recognized practice under such conditions on bridge of all transatiantic steamships. It seems to be universally held that, if a good lookout is kept on such a clear night as that of April 14th, it is practically impossible to avoid seeing an iceberg, long before it gets into dangerous proximity to the ship. Obviously, then, one of the lessons of this disaster is that now and again, even though the night be clear, there will occur conditions, such as a smooth sea and an iceberg of a color that approximates to the general coloring of the sea, which may make it impossible to detect the joe

make it impossible to devote the loc in time to avoid collision, and so may render a repetition of the "Titanic" disaster inevitable. It would seem from testimony given before the Board of Trade that conditions did render it extremely noard of Trace that conditions do render it extremely difficult to see this particular incherg. One officer of the "Titanic" testified "everything was against us," meaning that the size of the iceberg, its color and the absence of broken water at its base, made it practically impossible to detect the obstruction until it was close aboard

was close aboaru
In our investigation, above referred to, we found a
consensus of opinion, also, that the chances of avoiding
the ice when it was once sighted were as good, if not when the ship was running at high speed than when she was running under a slow bell; it being claimed that the ship would answer her helm more quickly at high than she would at low speed; which is undoubtedly true.

Now, since the steamship companies wish their ships to be run at full speed, if possible, all the way across the Atlantic; since the officers in command of the ships are unanimously in favor of high speed; and since the public, except when it is in a panie over some portentous disaster, in certainly in favor of high speed; it is mice to seems that appeal will not be identiced in the distinct oither in fog or among the long. Align widthing the 40,000 to 70,000 tons will continue to go hardling their 40,000 to 70,000 tons will continue to go hardling their vary-across the Atlantis, whether by night or by day, crueting to the sharp ore and the steady hand to award disaster. Evidently, if several is to be made sharplying each, that is to say, if the "Thanke" of the future award not occasionally to be sent to the bottom at slaper warning, carrying a multitude of people with them, something should be done to enable the airly undefinable under those special conditions when "everything in against" the ship and the lessen over and the steady hand are not sufficient to prevent catastrophs.

The Beard of Trade inquiry now going ou in London

hand are not sufficient to prevent eatsatrophs. The Board of Trade inquiry now going on in London will fall pitifully of its purpose, if it does not make such changes in the laws governing the structural requiriments for safety in future ships as shall make them practically unsinkable by collision, whether with agother ship, as in the case of the "Rigandic," or with the decellet, as in the case of the "Titanic," or with the decellet, as in the case of many a good ship that has safed and never been heard of again.

Battle Efficiency and Navy Appropriations

HE reluctance of the House of Representatives to provide the necessary appropriations to carry out the very reasonable program for maintaining our Navy at its proper relative strength, looks like a very poor recognition of the high state of efficiency to

hich our existing fleets have been carried. There may be other departments of the Govern which can show an equal rate of improvement; but we wmon can anow as equal rate or improvement; out we are certain that there are none which can exset the record which has been made during the past two or three years by our Navy Department. At the last analysis, the object of the money which has been spent and the infinite care, thought, patience,

has been spent and the infinite care, thought, patience, and hard work, which have so markedly characterised every branch of the Navy Department, is the main-tenance on the high seas of a fleet of battleships and crusers, characterised by the highest efficiency, and at all times ready for immediate action at the Government.

Government. Everyone who is at all familiar with conditions in the Navy to-day knows that this efficiency has been realised beyond the most canguine expectation. Not only are the latest battleships which have gone into the world in the accuracy and rapidity of their

from the longest ranges.

The fighting efficiency of our battleships of to-day, as compared with that of the fiest which fought under Sampson and Schied during the Spanish-American war, shows an improvement which is scarcely believable except by those who, like the writer, have had an opportunity to witness the work of the fleet from one of the battleships engaged. This improvement has cinctly stated by Mr. Meyer, th of the Navy, more than once during the past few months. A comparison shows that, whereas the percentage of hits in 1898 was 3½ with the large guns, firing about once in five minutes at short range, the percentage of hits in the firing last year at the San Marcou was 33 1/3. must in the firing last year at the ban Marcou was 23 1/5, the range being 1,0000 yeards, and the present rate of firing a single 12-inch gus being about ten shots in five minutes. This rather overestimates the work at Santiago and underestimates the work to-day. A roughly drawn companion above that we are about 1,200 times better in gunnery efficiency than we were a faction of Santineous.

So far then as the ability of our battleships and cruisers to hit the enemy hard and often at great ranges cruees to me the enemy hard and often at great ranges is concerned, it is certain, if we may adopt a current phrase, that the country is "getting its money's worth," If the pruning knife of economy must be used, it would be wise, surely, to spare a tree which is yielding such abundant fruit.

A New Method of Testing Coal

A New Method of Testing Ceal

S a test of the value and character of fuel, the
discovery of the amount of votatile matter in
cool is unpersionably of the very greaker
importance. This is sufmated by finding the fose in
weight of about fifteen grains of a sample, by bringing
it to a high temperature in a plaintum dish. This simple procedure really gives more information than any
detailed chemical or colorimation scalarist.

However, the complete accuracy of the test is not
always possible. The weight, length, bracketh, and,
intensity of the fame and the beat, as well as the judiciant
mum recognised which holds the sample, the nort of
sas and burner, the distance, time, and other confidence
time, all have some efficies upon the results, that is
upon the residue left and the velagite masters driven.

The committee on coal analysis of the American Chemical Society over twelve years ago made an ex-

with the

he distant for the medium plants of the control of waterlife materials. In the control of waterlife materials are selected to the control of the control of

pass, where well give a love to the difference in the cole produced from various sessions, which will account for the givens of excellence which will account for the givens of excellence and case. If will show a gualitative distinction broaders the satisfact the vasious types of soci, and statuture the facing of the old mothed, the picture will be sent to be first, clauses to which makes of the uniquely excellence to be first, clauses the white makes of the statuture, and fictionize could five due to the agriculture size of excellence and make and contract of the action of the statuture which the statuture which are considered as the contract of the picture of the picture of the statuture which was considered by sufficient of the picture of the p

and vapors are allowed free play.

Dr. Lessing's apparatus consists of a heating tube, a quarte glass cylinder. This non-conducting medium may have an selective resistance off of pitallium whre wound directly around it. Numerous glass pia points are heat on this tube to loss pite turns of the pitalium off apart. In order to concentrate the heat where it is required, the platitum wive is first wound to a close oot and this is wound around the cylinder tube. The coil attaches itself by its own disacticity. This coils are close at the bottom of the cylinder, getting wider and wider and wider apart, so that the beas is just mough to keep the coal tar volatilised. Another "rescrings" glass vessel file loosely into the other "heating" tribe. glass vessel fits loosely into the other "heating" ! Its interval diameter is about one third of an inch.

glass vessel fits locaety into the other "heating" tribe. Its interval diameter is about one bird of a fixed in Fifteen grains of the powdered cost are placed in the inner tube, and into a third tube which telescopes into the other inner tube. By altering the weight of this innermost tube or filling it with different amounts of quarta powder, during the test various pressures may be exected on the cost.

The outsernout tube is buried in an insulating substance such as kieselgulir. A cheestal consistent with the furnace allows various changes of resistance and the temperature may be accordingly altered. The test is made, by weighing the cost almost outside tube. Then the innermost tube is inserted over this and the temperature may be accordingly altered. The test is made, by weighing the cost into the middle tube. Then the innermost tube is inserted over this and the temperature below which the outsides, insulated tube. As the current is turned into the platinum cost, the temperature dowly rises, allowing the graditions and stops of carbanization to be research. First, tree moisture, then concluded guess, some to be followed by intry apport, will be seen inconsing in volume. All this depends upon the kind of coul testant. The heaving the individual super time the intervence took. The value test, requires adjoint at reflution, and is than permitted to each. The only obstanted shows the chains and of coult haspy particular, most in the profession of each laid of coult. By particular, most in the profession of each laid of coult is any particular, most in the profession of each laid of coult. The coult of the individual differences of each laid of them. All the individual differences of each laid of the laid. Any particular all the profession of each laid of each. Supporting the expension, each TD. Linding, '80 of claims to means for a general size of the particular and the profession of which is the count of the particular and the each case of the count of the laid.

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A Flying Machine in Leash

THE race for the Gordon-Bennett trophy is a thing of the past now. We all know how the "Baby fright" caused to grief at the very start; how Leblanc rashed isto a telegraph pole just as he had victory a kla grash; and how Graham-White carried off the coast, by a curious combination of luck and dogged-

Those who were privileged to take their stations hear the seroplane sheds, behind the swree, as were, of that stage where a great play was enacted, still remember with interest the preparations that were made. For hours and hours beforehand, mechanics were busy in the hangars. They scrutifized the motors with meticulous care, for upon them the outcome depended. They cested the sized cables that warped the wings; for if one of those wires broke, the machine would inevitably crash to the ground. They examined every nut, every bolt, every square inch of wood, until they knew to a certainty that the machines were in absolutely nerfect time. After

the signal to start. One end of the rope was released, and the machine shot forward. For perhaps two hundred feet it bowled over the turf at more than automobile speed. Then the steering column was moved ever so little, and the machine rose into the air.

How an Artist Discovered a Natural

I T is a curious fact that an extremely interesting natural law was discovered and brought to the attention of scientists by an arrist, Thayer, who was also a close student of bird life. With an arrist's reporting that an abande. Mr Thayer fit upon what the naturalists, despite their intimate familiarity with the many varieties of imitative and protective coloration in animals, had failed to discover, i.e., the reason why the under parts of fishes, reptiles, mannials, birds, and, in many cases, even inserts, are so generally white or light. This natural law has been briefly

inches above the ground. They were covered with a steley material, and that dry earth from the road where they stood was spirikled over them to give them the very color of their background. The two and ones were painted white on the under safe, and the white color was shaded up and gradually mixed with the brown of the suches.

When viewed from a little distance, these two end objects, which were with below, disappeared from a sight, while the middle one stood out in stonia relief and appeared much darket than 1 really was. It was explained by the investigator that birds and mannais, which are protectively colored have the under parts which, over hight in color, and that the color of the under parts usually shades gradually into that of the under parts. This is essential in order to counteract the effect of the shadow side, which other was, as shown by the middle object, makes the object abnormally conspituous, and causes it to appear much darket than it couldy is

Certain of the observers of these experiments could searcely believe that the striking difference in the



Photograph by the Pictorial News Co.

When the propeller of a high-powered flying machine is started, several men are needed to hold the machine in leash, as it were. The machine which these six men are struggling to hold back is Grahame-White's 100-horse-power Bleriot monoplane in which he won the Gordon-Bennett International trophy.

SIX MEN AND ONE HUNDRED HORSE-POWER

they had completed their work, the aviators themselves began an inspection no less painstaking and minute.

Grahame-White, for example, went over every part of his machine with a degree of care that must have seemed ridiculous to a layman. He shook the wings: he shook the frame; he shook the fall members in the effort to discover some loose part. He tapped the fuel tank and peeced into it to see that it was full He looked over every square inch of the propeller blades. At last he climbed into his seat Six men salegad a rope that traited behind the machine A man stepped forward and gave the propeller a twist The Obb-horse-power engine spluttered a moment, and then its fourteen cylinders, together with the propeller in the season of the season of the propeller as the season of the season of the propeller as the season of the season of the propeller as the season of the season of the propeller as the season of the season of the propeller as the pro

stated as follows. 'Animals are painted by nature darkest on those parts that tend to be most lighted by the sky's light, and vice versa."

In the open, it is true, the light commonly comes in from above, and thus the majority of wild creatures from above, and thus the majority of wild creatures are darker on their backs and lighter below, whetethe shadow of their own bodies upon the lighter color tends to equalize it with that of the upper parts. Thus, in the case of a dead bird with wond-colored back, the lighter shadoes on wing and wides and a white breast may look, when held in the hand, as if the conspicuous silvery appearance of the breast feathers would betray it to the eye of a searching to enemy. But, in reality, such is not at all the case it would be meth more easily discovered were it dull hyown all over. This curious fact was brought out by Thayer, and in open air meeting of ornithologists he conducted a series of cleverly devised experiments

Three objects, about the size and shape of sweet potatoes, were placed horizontally on wires a few

stability of the three objects was entirely due to the coloring of the under side and accordingly Mr. Thayer was requested to color the middle one like the two others, in order that the effect might be served. This was done, and the under side of the natidic object painted white, the white being shaded will up into the sides, as in the case of the others. The effect was almost might at The middle object at once disappeared from view.

Similar experiments were made on a hawn. Two potations were painted green, to resemble the green of the grass above which the vere asspended. On was painted white on the under side, and at one, became includible when viewed from a little distance while the other showed paintly and seemed very dark, the shadow, added to the green of the under side, making it extraordinally compression.

The rule of natural coloring which the artist proved like a scientist is general throughout the animal kingdom, and of much importance in preserving species from destruction

A Huge Electrically Driven Clock

A Timepiece That Served as a Dining Table

By the English Correspondent of the Scientific American



A N electrically driven clock, which is the largest in England, has recently been completed in Leicester England to adorn the tower of a new building that is now approaching completion. The time-piece possesses many interesting features, especially in connection with its mechanism

The clock is provided with four dials The clock is provided with row unlaw-with with be set 220, east above the sidewalk. Each disl meas-ures 25 feet in diameter. Owing to the exposed position of the clock, and the heavy gales that prevent in the neighborhood of Liverpool, special attention devoted to structural strength of the clock face.

The framework of each dial is of massive iron construction, and weight 31/2 tons. The opal glass is of great thickness, so that it may withstand a minimum pres-sure of 11 tons per square inch, that for each dial weighing 660 pounds The onter circle of the dial is construct ed in twelve sec-tions, each of which measures & feet 3 inches long by 5 feet 6 inches spaces are 14 inches apart. stead of using Roman or Arabi numerals to indisolid black uniform mark is utilized, rendering distinguish-

from a distance. Each of these chapters is 3 feet 6 inches in length by 18 inches wide.

The hands are likewise of large dimensions. Each minute hand measures 14 feet in length by 3 feet wide at the broadest part. They are made of copper, but to enable them to withstand wind pressure, and the forces of rain and snow, they are stiffened with a 9inch sunmetal backbone.

Then the clock was completed, the builders invited a number of friends to participate in a celebration luncheon under novel conditions One of the large

dials was supported on legs, to serve as a dining table, round which some forty people were comfortably seated

Apart from its unusual propor-

tions, the most striking feature this horological novelty is its driving mechanism, which is small, compact, occupies little space, and is exceedingly simple, weights and intricate arrangements of wheels being entirely eliminated. Winding is also dispensed with The principle upon which it is constructed to the same as that employed to drive a small dining-room clock

This system is called the "waiting train" movement, evolved by, makers, and the outstanding feature is that the time-keeping por tion of the clock is disconnected from that of the hand-driving. This arrangement effectively overcomes any interference by rain, wind, or smow, which might tend to retard the forward movement of the hands. The clock is driven with a practically continuous motion, but

its design secures the separation of the time-keeping element of the clock from the hand-driving element, the desirable result that any untown brought to hear upon the hands cannot react upon the time keeping. The motion of this mechanism is governed by a precision time transmitter, the invention of the builders, which is now being so extensively employed for observatory clocks. This transmission is connected by General Post Office telegraph wire with Greenwich Observatory, so that the clock may be natically corrected when necessary, thereby insuring absolutely correct Greenwich mean time.

an ingenious arrangement has been incorpo on the necessity to ascend the tower to adju the lighting and extinguishing mechanism for a car tain period, at the expiry of which further adjust tain period, at the expiry of which further adjustment would have been required. There is a movel cam, mounted within the switching apparatus, by means of which the switching on and off of the electric light; are altered to suit the time of year, by automatic agency. By means of a simple reducing man, this cam is caused to make a complete revolution when it werey two years. Even the error due to leasy year; a coveraged it is commenced in the law of the production of the produ every two years. Even the error case to make corrected, the compensation being so nearly complete that the error is

only 10 m in thirty years. At the end of this period it can be corrected and set years, in the answer of one mittle recourse to tools

ing from the sen, to give all the sary to mariners for avoiding the dangers of intriing access to rivers or to ports with sandy bot-

has been had in the first place to lightships and later to luminous

necys.

The first attempts in this line were made in 1821, and in 1882 they were much existeded.

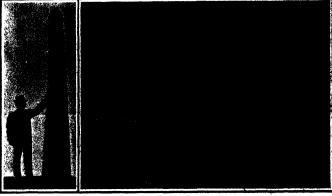
The fears entermined for the stability of lights

subjected to ;

It was found by experiment that devices could be employed which rendered the light practically inextinguishable and furnishing continuens service for months at a time. It has even been possible recently to provide them with incandespent

mantles of about wight hundred hours durability and so firm of texture that their service is terminated only by exhaustion, since runtures are exceptional

Thanks to these, it is now possi-ble to outline with heacons either very tortuous channels which would be difficult to mark and folland; or passages distant from the at when for often absoures servation of the alignment; whose frequent alteration of out-line may be easily demoted by a



One of the hands

Part of the simple and ingenious driving mechanism of the clerk

The dials of this huge clock are to be electrically ere is a very ingenious apparatu which automatically switches on the light at dusk, and switches it off at dawn. The times of lighting and extinguishing, however, vary with the seasons, being 4:20 P. M. in winter and 10 P. M. in summer for lighting, with an equal fluctuation in time for

Inasmuch as the utilization of the "waiting train movement renders it unnecessary for the tower to be ascended to wind up the clock and correct the time,



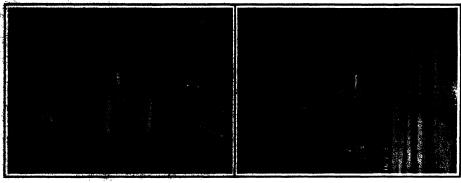
Luxurious Private Car for South America

How the President of the Argentine Republic Travels at His Ease

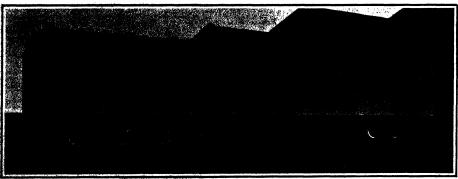
amounts' (antireless private est has recently the first private est has recently the first private est has recently the first private est private the first private est privat ing set back about 16 inches from the outside faces e car, and the sides of the body being curved in to most them, while the roof is taken straight through and forms a canopy ever the steps. Another attractive feature is the rounding of the ends and

observation room, which is finished in hand-carved mahogany, painted white, and paneled with green slik, includes a fireplace with marble hearth and fit-The furniture in this section of the car is of the finest Spanish mahogany, all upholstered in dark green leather. The floor covering is also of green

One of our illustrations shows a part of this room, and another the bathroom adjoining the bedroom of the President. In all these the most artistic electric light fixtures are installed, and they have a particularly pleasing arrangement of the ceilings of the sleeping room of this section are of dark blue with carpet to match. In the bathroom the walls and doors are paneled up to the window sills in which was obtained from the use of the steam tur-bines in the St Denis plant. One of the new stations will lie in the northern suburbs at St. Ouen, and the second in the southern suburbs at Issy. Worl the second in the southern suburos at issy. Worn will be commenced very shortly upon these plants, and orders have been already piaced for the steam turbine groups. These are composed of a steam turbine working with a surface condenser and coupled direct to a two-phase alternator of 10,000 kilowatts. The alternators deliver current at 12,300 volts and 42 cycles and run at 1,250 revolutions per minute. On the same shaft are mounted two smaller direct current generators, one of which serves to excite the alternator and the other to give the current for the two condenser motors. There will be used ten steam



The bathroom, finished in marble, contains a shower bath



Built of steel, this car is 78 feet in inggth and 10 feet 6 inches in width. Note the center door recessed into the car

THE LUXUESOUS PRIVATE CAR FOR THE PRESIDENT OF THE ARGENTINE REPUBLIC

the location of the windows on the corners, permitting ptionally broad views from the observation room

riginally broad views from the observation room, summal space has been provided for ideopting autom-tions, as is shown in the bedroom of the Presi-wijch measured 7 fort 3 inches by 12 feet 6 in hind; is additioned by a beatroom 6 feet by 7 feet se. The our measures 72 feet in length and has 81 feet 15 feet beates. 21 in carried on two body stool friends, special attention belong payed

marble, and the fixtures are all nickel throughout The library is done in red.

On the exterior the car is sheathed with steel and painted an ivory white with decorations of blue and gold. The window frames are of polished brass, and the underframes and trucks are painted a light gray. The car is electrically lighted, current being furnished by two axle generators.

The Paris Electric Plant

The Paris Electric Plant
Sours additional points have been added to the two
larger discrete plants which are to be created for the
future discrete plants which are to be created for the
future despite of paris. It will be remembered that
be building of these stations was simple to deone of the spatialists of the contract passed between the
future discrete plants with a the
future discrete plants with as the
future discrete plants with a the
future discrete plants with a principal olectric groups.
This wish principal of the principal olectric groups.
This wish principal open wring the the great success

turbine groups in the north station and seven in the south station, and it is stated that five of the total number of turbines are of the Brown-Boveri type The five corresponding groups will be built at the Jeumont and the Fiveshille works in France. The steam consumption of these turbines which work on superheated steam at 300 deg. C. (578 deg. F.), and at a pressure of 18 atmospheres, is given as 33 kilogrammes (73 pounds) per indicated horse-power, using cooling water at 15 deg. C. (59 deg. F.). Each turbine group complete weighs about 805 (long) tons, and the turbine alone represents 130 tons. The alternator figures for 70 tons and the surface condenser for 61 tons. The total length of the group is 17 30 maters (57 feet) counting the turbine itself for 9 10

To Attack Paper Labels to Iron -Rub the Iron at the desired spot thoroughly with an onlon cut in half, and then stick the label, previously smeared with paste, guin or give, to the spot.

Variations in Saturn's Rings By Prof. Frederic R. Honey, Trinity College

THE marvelous ring system of Saturn renders that distant planet one of unrivaled interest as a talescopic object, because of the hashing mystery as to the constituent elements of the luminous bands which move in harmony with the revolution of their primary. The theory of rigidity having long since been discarded as untenable, the assumption that they are meteoric swarms is accepted as a working hypothesis in any study of the Saturnian system. The

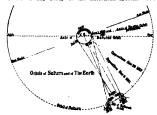


Fig. 1,-Plot showing difference between Saturn's distance from the Earth at perihelion as compared with that at aphelion,

past and the future history of Saturn's rings suggest many interesting and pertinent inquiries, e. g.: How did the rings assume their present form? What has been their change in character during the centuries? And, finally, what is the probable future of these mys-

And, finally, was it at the produce turns of cooler and refrome metoric swarms?

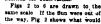
Saturn is now in the most interesting quarter of his orbit; and as the planet is in the northern heavens, it is seen to the best advantage in northern latitudes as evening star. At this time Saturn is approaching perihelion and steadily nearing the Earth, which will be apparent on an inspection of the plot. The center of the orbit is at c, which is nearly fifty million miles from the Sun, and the great difference between the planet's distance from the Earth at perhelion as compared with that at aphelion, is apparent even in as small a space as the plot here illustrated. At perihelion the apparent diameters of Saturn and of the rings are one and one-eighth larger than at aphelion, and as the plane of Saturn's orbit is inclined at an angle of nearly 2½ degrees to that of the Ecliptic, it will be seen from the illustration that Saturn is now not far from his maximum distance below that plane.

Variations in the apparent form and dimensions of Saturn's rings are dependent upon two conditions: the position of the planet in its orbit and that of the Earth in its orbit. During the year the apparent diameters of the rings, and also

1910

Figs, 2-6.—The ap-

diameters of the rings, and also diameters of the rings, and also the proportion between the major and minor area of the ellipses, change perceptibly. This is due to the changing direction of the line of vision shown in the plot of the orbits of Saturn and of the Earth. The positions of the planets are shown at the dates of conjunction, April 18th; of quadrature, July 29th; of opposition, October 20th, and also for January 1st, 1910 and 1911. The plane of the rings moves into parallel position, and at intervisio of about fifteen years, when this plane passes, when this plane passes through the Earth, an edge view is obtained, and the rings appear as a straight line. The last time this occurred was in 1907. Between seven and eight years after this date the rings will open to their greatest apparent which, and will thus be in the most favorable position for observation.



be the apparent form and diameter of the planet and the rings at the date of conjunction, when Saturn reaches his greatest distance from the Earth in 1910. At quadrature (Fig. 3), when Sayurn is nearer the Earth, the apparent diameters of the planet and the rings are increased, and also the proportion between the length of the minor ax's to that of the major axis the superstance of the Earth relative to Saturn at this date, as shown by the Shrind line. Fig 4 shows the planet and rings at oppettion when the Earth's distance from Saturn is disnistance with the Earth's distance from Saturn is disnistance with the position of the planets at conjunction. Since the Carlot of the Earth's orbit, as ecompared with the position of the planets at conjunction. Since

different positions in its orbit; but in order to deligner the danger in the again of the elligent from gain, to year it is desirable to represent the dark the fisher of opportion, which occur on the average therein days later such year. The plot shows the positions of the planet at the dates of future opposition, vits. November 28th, 1811, and 1811

Figs. 5 and 6 show the widening of the rings, or the proportionate increase of the minor to the major aris of the ellipse. The positions of these axes obviously vary with the latitude of the observer, and are therefore not indicated in the drawing.

The Squaring of the Circle By J. F. Springer

THERE are certain infatuations which seem nevor to die. One of the hardiest of these concerns persual motion. There are probably quite a number of men in the United States to-day industriously working at this impossible problem of setting something from nothing. It is possible that they sever can be convinced that another cog-wheel here or counter-weight there will be ineffected in reversing the principle that an effect must have a compelent cause. Another and perhaps (if that be possible) more immortal infutuation concerns the squaring of the circle. An intelligent (even though not exhautive) apprehension of the real character of the problem and what has been accomplished is perhaps the very best method of percelving the fullity of seeking to square the circle by mechagical means or by the processes of Euclidean geometry.

Strictly speaking, the problem of the quadrature of the circle is concerned with the determination of

Strictly speaking, the problem of the quadrature of the circle is concerned with the determination of a square whose area shall be equal to that of a square whose area shall be equal to that of a square whose area shall be equal to charge of the circumference and the diameter. However, the ancient Greaks were aware that the area of a circle is equal to one-fourth the rectangle whose sides are the circumference and the diameter. Consequently, if the circumference to be particular circle could be found, it would easily be possible to complete the solution of the problem. Purther, they also knew that the ratio between the circumference and the diameter of the circle. The circumference and the diameter of the circle. The circumference is any particular case would then be readily obtainable for one knew that invariable ratio. The result of these circumference, is that the problem of the quadrature of the circle reduces useful to that of the rectification of the circle reduces useful to that of the rectification of the circle ratio between circumference and diameter. In modern mathematics, this ratio is represented by the Greak

What was, perhaps, the greatest mind of antiquity attacked the problem of the determination of r. His general method of probedure sufficed in his hands of produce a good approximation and has been effective in modern times of yielding results accurate beyond all present or future needs. In fact, the value obtained by Archimedes considerably more than 2,000 years ago is better, probably, than the figures arrived at by most of the modern "tircle squarers." He described has a large of the second of the second of the second at 17 most 18 to 18

It will be instructive to set forth the essentials of the Archimedean method. Cónceive—Fig. 1—the circle to be insertibed and also directamenthed by a regular hexagon. Assuming, as well we may, that the perimeter of the circumarribed polygon is greater than the circumference and that the perimeter of the insertibed is less, we easily see that it we calculate the ratics of these two perimeters to the diameter we shall in the one-cases have a saidle greater than r and in the other a less ratio. Consequently, the value of r lies between the two. New Archimedes was able to calculate not only the perimeter of the circumserbed hexagon, but of the negaliar figures having 12, 24, 48, and 38 sides. He found the ratio of the perimeter of the dispose to the side ameter of the circle to be 31.77. By a stratific process of passing from the required inscribed hexagon to the polygon of double the number of sides. This perimeter of this he found to bear the ratio of 3 significant the disposition of the disposition. This perimeter of this he found to bear the ratio of 3 significant to the disposition of the disposition of the disposition of the disposition. This perimeter of this he found to bear the ratio of 3 significant of the disposition of the tension of the disposition of the

There exerts to have been no advanta made and out perhaps to accuracy, and the main them when tripmenderly and the calcular may placing distributions of the calcular may place of the calcular may place of the calcular may be a supported to the calcular manuals of the calcular calcular manuals of the calcular calcular manuals of the calcular ca



Never for 2 me.

Story for the last target formation to between them, 50 correctly represented by the place. Bright for the fine of the fi

Now the value of a just given enables calculation to be made with a wonderful degree of problems

New the value or y just to be made with a wead Monitole, the great historian of mathematica, hes estimated in effect that if a circle be described with the essenance radius of \$25,000 chms, our distance from the sue, jis varietion from the tritter of the circumferwace calculated by means of this value of v westle be so must be successful by means of this value of v westle be so must be successful by means of this value of v westle be so must is not out to be hardled to currently and the successful by the successful of our best mixture.



cossopes or say that will conceivably he impossed in the future. It may be indeed from the initial medium maticians are in no need of a done accounts determined attention to the type yet in each seast, the exclusive of w has been couried might further gions the despite of w has been couried might further gions the despite of Ludelph in 1810. In fact, one composed, the calllated the value to shoot 800 decimal places. This result has been confirmed. Another conjugate the carried the determination to 190 places, first, this result, on far as I am informed, has not been deleting. Home "introle squarers," It would appear, halpend under the determination in order to calculate with precision of w kind of the confirmation of the longitude at sea. This is a antrage. The value of w known to Ptolemy needy sightless dunding the age is anny sufficient for all practical proposes. It is entirely unnecessary to use the closer approximations of modern times. Another history is quite good

What mathematicians have been interested in, has been to settle the question whether "sould peembly the bed determined by the processes of entitings; geometry. These processes recognize but two machinelal instrument—rules and compasses. This matter has been in agitation for a long white, but seems to have been in agitation for a long white, but seems to have been the processes of the processes

It seems that many "circle squarers" have been under the ingression that a large government reward had been offered for a correct solution. Thus, as agricultural abover who had devised what he imagined was a colution came to London said there submitted it to Prof. de Mongan, who was then comparing the attention till unwestiv. Colleges. Abompsaying the attends obtain an edge of solution was a copy of a letter in which do

letter in which demand was made upon the Lord Obanciller for a supposed price £180,000 (\$485, \$600). Prof. de Mergan wise unable to regard the mathematical effort as successful. In returnlang till uppers he comistical than he did not think the author possessed the knowldigs, seguintitie to



between the Distinct the sand the

he profesor. This was resided to by the each very consistive recently that Frod. As discussed should reduce the Technique and appropriate the time said subsidiary as Studyn School to Learn what he Coold, and Seep he Littler Others there investor there there is

If me, buf supposeded in state of the state so and originated a mechanical solution—or, at the what se thought was a solution. How worthless any mechanical method would be, from a practical tof view, even to-day may be seen from the fact that prebably the very utmost accuracy of our best ents is only to 0.0000 inch. So that even if, for instance, we roll a perfectly round disk on a perfect plane in a perfect line until we have accomplished one perfect revolution and thus determine a straight line equal to the circomference, how are we to measure this line? How-ever, Lacomune applied himself to reading, writing, and arthumett and satisfied himself arithmetical as it. its "solution." His efforts to get the attention of learned secieties culminated at last in the appointment of a committee of investigation by a certain Successful of Arts and Sciences in Paris. This organivoted him a sliver medal of the first This recognition was followed by the award of three er medals by various societies. All this sounds sted to investigate the matter, regarded the awards of the medals as possible, but was unwilling to con-ceds that the societies were probably of high stand-ing. The Franch Academy had passed a resolution re of a century before to have done with equaring propositions.

But it was not merely England and France that were able to produce "circle squarers." In 1840 there ware and so produces turns agrarers. In 1840 targer was published in Hamburg a contused and complicated treatise on this problem. The author regarded biguest as sutrety successful, as the following inguige quoted by Prof. Schubert implies: "And thus "And thus it has pleased our mother Nature to withhold this precious mathematical jewel from the eye of human investigation, until she thought it fitting to reveal truth to simplicity." His "solution" would seem age deciphered by Prof. Schubert—to be as follows: The circle in Fig. 2 is larger than the inscribed sequence and smaller than the circumscribed one. Now the smaller square consists of four triangles and tae or square consists of four triangles and the larger of eight, the triangles being all equal. Con-sequently, the area of the circle is to be found between the two limits. This "solver" put it at six triangles, that is three-fourths of the larger square. This would rield 3 for the value of n-a result that a string and a dinner-plate would have corrected.

One of the most learned men of all time was Joseph But his learning—in the acquisitive Sealign. But his learning—in the acquisitive branches—did not prevent him from becoming affected with the infatuation of squaring the circle. In 1892 the published a "solution" in a work entitled Nous Opelometrics (A New Science of Circle Measuring). This was refuted by one or more of the mathematiches of the time. Scaliger is said to have main-tained the destribe that an are is less than its chord in arthematic, but greater in geometry. This proposition his describes as a "note paradox." He seems regarded arithmetic as a kind of Land of the

ourth Dimension where any stilly thing might be true Cardinal de Cusa, who lived in the fifteenth can Charithnia de Cuesa, who lived in the Siteenth can-tary, gave a muest curious geomatrical "foultion." In the given clouie he inserthed a square. He then used a side of this ma radium. In the resulting circle he inscribed an equitatoral francis, whose perimeters he misintained was equal to the circumfer-tion of the original wirele. He mas retuted by Regio

The title does not exhaust the list of the eminent sensings, "Channe Hobbes, accounted one of Englishes," Channe Hobbes, accounted one of Englishes, "Channe Hobbes, accounted one of Englishes, "Channe Hobbes, accounted and the englishes of the englishes and the englishes of the

The Loss of Aviator Grace

The fears expressed in our last lasue as to the fate of Mr. Cecil Grace were well founded. He was see ne coast guardsmen over Goodwin Bands about five miles out at sea some fifty minutes after h Although at first heading for the English France. shore, he suddenly turned and went off in a north It is thought that he mistook the cliffs for fog banks, steered away from the shore, and was lost in the North Sea. He was flying a Short-Wright biplane, which is a modified Wright machine of the same sort as that in which he first learned to fly and in which, last June, he made the first flight in E land to be made over warships. On this occasion he also flew from Eastchurch, on the Isle of Sheppey, passing over Minster and Sheerness and circling above the warships "Victorious" and "Bulwark" at a height mber 22nd, when he left France, Mr. Grace is said to have carried enough fuel for a five at. At first there was a report that his aeroplane had been found near an island off the coast of nd, but this was not true. The captain of a Channel steamer also reported passing wreckage that resembled an aeroplane; but at the present writing no authentic traces of man or machine have been found This makes the second airman that the North Sea has swallowed of late, as only a few weeks ago one of three balloonists was lost overboard when the basket of the balloon struck the water in a fast flight from rmany to England in an aerostat, Mr. Grace was another aviator like Rolls, whom both the entence and sport of aviation can ill afford to lose.

New Records at the Los Angeles Aviation Meet

For the second time last year a new height record was made at an aviation meet at Los Angeles on De-cember 28th. The new record is 11,474 feet, which is nearly a thousand feet higher than the gneux made in France on December 9th. The sariler record was made at Los Angeles by Louis Peulban, who on January 10th, 1910, reached a height of 4,184 feet in his Farman biplane. All these beight ords have been made with biplanes, the latest one being made with a standard Wright machine. Mr Housey is the Wright filer who reached this height of well over two miles, and that he succeeded in accom-plishing it in windy weather and in mid-winter, when the cold at this elevation is intense, speaks well of him as an aviator. His new record was made early in the third day of the meet and when there was a wind of es an hour or more blowing. He was in the air over two hours, and was so benumbed by the cold that he was able to centrol his machine only with the greatest difficulty. After he had risen a few thousand feet above the earth, he found fighting the wind was necessary are early, he round igniting the wind was much easier, and that the chief thing which he had to contend with was injense cold. In the course of his flight he circled abogs over a wide stretch of country, and on several occasions he was over a mile out at sea. He was out of sight of the spectators for over one , but his machine was observed through telesc and his height measured by triangulation as well as

the registering baron The same day that Mr. Hoxsey broke the altitude secord, Hubert Latham smashed his Antoinette mor plane when alighting in the teeth of the wind. He had flown magnificently for two and a quarter hours. and only came down when his fuel supply was getting He had spare parts for three machines, and by working his mechanics steadily he succeeded in re his monoplane in less than forty hours, and fiving again two days later. Previous to the meet am tried duck shooting from his monoplane He flew low down above a marsh and started the ducks chasing them out over the ocean and shooting at them a number of times. He succeeded in bringing down several. On Christmas day, which was the second day of the meet, Latham remained aloft all told over e hours. He made two flights of one hour and forty minutes and one hour and twenty-five minutes respectively. Latham and Willard competed in the bomb-dropping contest, and both did equally well in dropping bombs upon the diagram representing a wi ship. Archie Hoxsey rose to a height of 9,288 feet the first day of the meet, while he reached 7,922 the s day. The third day he made his new record, and the fourth day be reached the height of 6,800 feet. On the fourth day, Decamber 28th, a Curtiss machine driven by Ely best a Wright biplene driven by Parmalee by half a kep in a Evelap race. The time was 10:05 2/5 half a lap in a flye-ing race. The time was 10:05:5% for a distance of §5, mine. Seedless this race there was another held the following day between James Radley, the English myseld champion, on his Bieriot. Biy on his Curtim, and Engusiaes on a "aby" Wright. This event was formularraigh a distance of §5; miles, and was twen by His-Radleys in 218:15.—an average speed of about 40 miles on bour. His factors lap was made

at a higher rate. Hoxsey made a cress-country flight to Mt. Wilson, some 36 miles distant. He was gone about two hours, and reached an altitude of 8,200 Radiey also made several cross-country going to Long Beach and back in one of them. Parmalee did some fast turns with his "baby" Wright, and Walter Brookins, besides carrying a passenger, made brated spiral dive from a height of 2,000 feet. Glenn H. Curtiss prepared his new racer, with which he expected to make a demonstration before the close of the meet.

Mr. William W. Holt

Mr. William W. Holt one of the natent etternave of the force of the New York office of Munn and Company, died on the 27th ultimo at Managas. Va

Mr. Holt was a native of North Carolina, having been born at Burlington on February 27th, 1876. graduated from the Manchester-Virginia High School at the age of sixteen and continued his education at the Virginia Military Institute, taking the full course in civil and mechanical engineering

After graduation, he entered the employ of the Southern Railway Company as assistant engineer and draftsman, but resigned from the service to accept a position as machinist in the Navy Yard at Washington, D. C. Here he gained that practical shop experience which was to be of so much benefit to him in his subsequent career as a patent attorney On April 25th, 1902, he was appointed an assistant examiner in the U.S. Patent Office Here he remained for nearly four years. On April 1st, 1906, he resigned to enter the service of Munn & company

Mr. Holt was admirably equipped for his work as a patent attorney He brought to his profession the technical education, practical shop training, and the Patent Office experience which eminently fitted for the work of a patent solicitor.

He had a fine, well-ordered mind, a wonderful capacitation ity for work, and an earnestness, and a wholesome sincerity and honesty which impressed all who came in contact with him. His genial personality will be missed by those who knew him

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The Current Supplement

A London newspaper has installed machinery for aking its own paper That interesting plant is described in the opening of the current Surphement, No. -An interesting summary of Prof. Daiby's British Association paper is presented, or rather of that phase it in which he calculates locomotive power in terms of tons of total load, including engine and tender ed, and train resistance.—An excellent review the progress made in aviation in 1910 is presented by Réne Gasnier—Dr William Eichholtz points out the limits of our chemical knowledge—The results attained by the Metropolitan Museum of Art's Egyptian Expedition are presented by Mr H E Winlock -Owen Ely traces the origin and development of the conception of ether.-The question "Do fishes red by Dr. William Roth in a summary "Interesting Recent Biological Investigations."

A \$20,000 Prize for Inventors

The Paris daily journals announce that a prize of \$20,000 has been offered by a person whose name remains unknown, for a life-saving device to be applied It is to allow the crew to leave to submarines. marine, and mount to the surface and keep affoat The matter is placed in the hands of the Minister of the Marine, who is to open a contest for such de-vices. Only French subjects can compete for the prise. This will be awarded should the device be approved by the Council of the Marine.

Prof. Albert Abraham Michelson

The New President of the American Association for the Advancement of Science

By Marcus Benjamin, Ph.D.

A CHIEVEMENT in science has usually been promptly recognized and generously rewarded in this country. Among the honors that are gladly accorded to those who have been successful in attaining eminence in science, is the preddency of the American Association for the Advancement of Science. An eligible recognition of attainments of the person so chosen. The practice of alternating a student of one of the physical sciences with a representative of or the natural sciences is an excellent one, and its wisdom was demonstrated at the last meeting of the foremant physicial in this country. A Michalson, assistant foreman physicial in this country section succeed so prominent a naturalist as Durid Starr Jordan. Prussian. Prussian. Prussian.

Prof Michelson was born in Strelno, Prussian Poland, on December 19th, 1852, but as a boy came to the United States, settling with his parents in San Francisco, Cal., where he received his early

Francisco, Cal., where he received his early education, studying in the public schools and then graduating from the High School and then graduating from the High School and applentiment from Preddent Grant to the U S. Naval Arademy followed, and he was graduated as midshipman in 1873. After nearly two years seen service he returned to the Arademy as instruction of the Arademy as instruction for about a year served in year served in year served in the Granden of the Nautical Almanac.

Yielding to his fondness for research, he

retaining to mis notices to the execution, we resigned from the U S. Navy In 1881, and studied for two years in Europe at the universities of Derlin and Heidelberg under Heimholtz and Quincke, and then at the Collège of France and Brole Polytechnique in Paris under Cornu, Mascart, and Lippman In 1883 he returned to the United States and entered on the active duties of the professionability of physics in the Casas School of Applied Steinger in Cleveland. Ohlo, to white he had been called, and remained there for six years In 1889 he resigned from that appointment to accept the chair of physics in Clark University, Worcceter, Mass Three years later he was called to the University of Chicago, then recently recreasized, and was made professor and head of the department of divisions and the professor and head of the department of inverse when leave to hear on the professor and head of the department of physics which slopes he has strone hadd

physics, which piace he has since held. While on duty in the department of physics in the U.S. Naval Academy, he developed a fondness for investigating problems in physics which culminated in his determination of the velocity of light to be 188,305 miles a second, an achievement which immediately gained for him recognition as a brilliant investigator. He continued his researches in that branch of physics, and during the winter of 1880 deviced a method for tegiting the relative motion of the carth and the ether, which resulted in the invention of the interferometer. An important investigation of

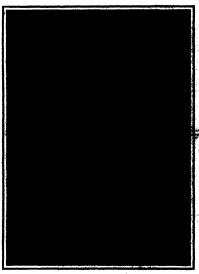
his made in connection with his colleague at the Case School, Prof. E. W. Morley, was the study of the application of interference methods to astronomical and spectroscopic measurements. The resulted in a device by means of which the diameters of Jupiter's satellites were measured at the Lich Observatory, while the latter showed that, of the many radiations examined, nearly all were more or less complex. Among the more simple, one was found which promised to fulfill conditions necessary for a standard of length, namely, the red radiation from cadmium vapor made luminous by the electric dis This resulted later in an invitation to demonstrate his work before the International Committee on Weights and Measures at Sevres, France His re sults were so convincing that his method was adopted More recently he has devoted his attention to the analysis of spectral radiations and the effects thereon of temperature, pressure, and of magnetism; and in the invention and construction of apparatus designed with a view to increasing the power and efficiency of spectroscopic appliances. Among these may be mentioned the echelon, which has a resolving power ten times as great as the largest diffraction grating, and a ruling engine capable of the

nost minute ruling.

In honors Prof. Michelson ranks highest among American men of science. Western Reserve gave him the degree of Ph. D. in 1886, and Stevens Institute of

Technology conferred a similar hence upon him in 1857. Cambridge in England bestowed upon him the degree of 8e.D. in 1899, and Yale in 1901, and Penayivania in 1906 conferred upon him the degree of LLD., while Clark in 1906 gave him the unusual but most appropriate degree of D-Phys. He was awarded the gold Rumford medals of the American Academy of Arts and Sciences in 1889, and in 1904 he received the Matteneci medal of the Societa Italiana of Rome. The Copley medal, the highest distinction of the Royal Society of London, was conferred upon him in 1907, and in the same year the Nobel prise in physics of \$40,000 was given to him, "to signative as worthy of a special shone the eminentity aucoessful researches you have carried out." He is the only American who has thus far received a Nobel prise in science.

In 1899 he delivered the course of Lowell lectures in Boston, and he has represented the United States



PROF. A. A. MICHELSON

President of the American Association for the Advancement of ficience

on the International Committee of Weights and Measures since 1900. Also in 1900 he received a grand price at the exposition held in Paris during that year, in recognition of his scientific researches.

Prof. Michelson is a member of many scientific societies. In the United States he was elected an associated. In the United States he was elected an associate science in 1885; a fallow of the American Philescent Science in 1885; a fallow of the American Philescent Science in 1885; a fallow of the American Philescent Science in 1885; and besides membership in many other societies, in 1900 he was elected ship in many other societies, in 1900 he was elected in 1885 he was made a corresponding member of the British Association for the Adviscement of Science; and in 1908 a corresponding featow of the Rayest and in 1908 a corresponding featow of the Rayest Society of London. He she had been been solved to the Rayest with many other European societies, including the Pronch Academy of Sciences (1900), the Veterskaps Akademien in Stockholm (1984), and the Senie Accedentia of Linnel in Royel (1998).

kaps Akademien in Stockholm (1986), and the Reals Accademia dot Lincel in Route (1996). His connection with the American Association for the Advancement of Science began with his wholeso to membership at the Nashville meeting in 1877. Twee years later in reas advanced to the greak of policy. In 1837 he was chosen a videopressible with simulation, and dailysers in relating address belder the Sigtion on Payrics in 1838, smitted "A Fine for Light Waves," in which he presented with great descriptions the many possible applications of the interferonment At the Boston meeting in January last cause hill well minanting relation to the association by its election to the presidency, an hence appropriately configured upon him, who since the death of Sitton Newcomb easily aucceeds to the distinction of being the greater man of science now living in the United States.

Uncle Sam's Mine Rescue Cars By M. M. Hunting

The appaliting loss of life in American coal mines the past year has moved the Bursau of Mines to take active steps in the preparation of adequate appliances for rescue work and the training of mean in their use. That the number of deaths in Ameri-

can mines, both coal and metal during the year 1908 should be about 5 out of every 1,000 employed, and that of European countries only about 2 out of every 1,000, has caused inquiry; and it has been found that this automiding difference is largely due to the fact that for some time past these European countries have maintained efficient rescue stations.

With the hope that this happy condition

With the hope that this happy condition may be duplicated in our own country, the Bursesu of Mines has recently equipped six cars with the latest apparatus for receive work, including also first-aid materials, and has massed them with experienced miners trained to this work.

These rescues care actioned at the great coal-mining centers, and will be sent out at a moment's notice to the scene of a classic to cooperate with the State minimum to cooperate with the State minimum to the coal minimum to t

A surgeon from the American Red Cross
Selectify and a mining engineer are members
of the crew of each car, and will deliver inctures upon the use of explosives, electrical
appearatus, fire prevention, sanitation, etc.
These lectures will be given in the cars
when other esitable meeting piaces are no;
available. The car will remain long enough
at each place so that every miner may have
an opportunity to learn the work of rescue,
under the instruction of the foreman of the
car, a precision imber. The men will also
be encouraged to form rescue brigades at
the mines where they are supjoyed, sequesing the operators to equip them with necessery apparatus.

Each car will contain eight so-called oxygen helmets, a supply of oxygen in tanks, twelve safety lamps, and a field telephone with 2,800 feet of wire, resuscitating outsits, etc.

One end of the cav is fitted with an airtight room in which the training of men in the use of the oxygen helmet is carried on. This room is filled with noxious gases, and miners wearing the oxygen helnets will be required to enter and remain for two hours. These helmets permit the wearer to enterands immediately after an explosion, while the aimosphere will reads with potsorous gases, subsist-

hours. These hainest permit the wearer to enter a mine immediately after an explosion, while the aimorphere will reake with potentions gases, substitute ing meanwhile upon the expusa from she tank. Had these helmest been available at some of the recent nime disasters, it is believed that many lives might have been saved. It is not infrequently the case that there are only nightly injuged, by explaints, but periah because of the principles o

The Mx three will be statement at the followin points: Root Springs, Wye, Stilling, West, and Lake Six, Utah; Urens, Ill., Reporting Pas.

The Heavens in January

By Henry Norris Russell, Ph.D.

woodern methods of scientific research frather curious situations sometimes arise, wis in tiltuarized by a record case, when an astronomer sent in a requisition for the purchase of "two thousand pounds of too, for use in astronomical observations." What the few was used for, and how successful were the results, is told in a at paper by Frof. Stebbins, of the University of illimote, who has for some years been working on the measurement of starlight with the aid of the

This last phrass may seem to increase the puzzle. What has the rare element salentum to do with astrokomy? Things become comprehensible when it is remembered that a thin sheet of this substance, suitably prepared, decreases in electrical resistance when light falls on it. By putting such an apparatus

at the focus of a telescope, and pointing at a bright star, the amount of light received may be measured, by means of the deflec-tions of a sensitive gal-

Temperature changes affect the selenium large-ly; hence the use of the s, forming a large "pack" about the case in which the selenium cell was con-tained, and protecting it from variations of temper-

Having got this apparatus in efficient working order, Prof. Stebbins has made a long series of measurements on the variable star Algol, with very interesting results. The sc curacy of measurement of which the new apparatus is capable is very high, so that the well-known changes in Algol's light. during the eclipse which it suffers at regular interly followed.

Continuing the obtions throughout the period, it was found that, half way between successive eclipses of Algol by its invisible companion, a small but undoubted diminution of light took when Algol itself would eclipse the companion; showing that the latter was not wholly dark, but gave out light of its own.

e eclipse of the com panion by the principal

er, cuts off but 6 per cent of the combined light of the two; while, when the principal star is eclipsed, shout 62 per cent of the combined light is obscured. The small loss of light in the former case is imperceptible to the ordinary eye, which explains why it was not previously detected, though a long series of

speciotitie to the ordinary ere, which explains why was not previously decided, though a long series of severalment with the best yieual photometers (informants for measuring the light of the stars up best cheevestion) would doubtless have revealed it. Sesides all this it suppless that the combined light it he two stars, when no ordine do taking place, is and when the companion in passest use—almost, neglect seat of the companion of a passest use—almost, neglect seat by the about force in the companion of the passes use—almost the passes when the companion of the passes when the passes were companion in freshitter on the day to warm the companion of the passes when the passes were the passes of the passes o

ity of the orbital motion of the bright star. As the faint star cannot be spectroscopically observed, some assumption concerning its mass or density is necessary. Making the assumption, which seems very plausi-ble, that its mass is one-half that of the bright star, Dr. Stebbins arrives at the following conclusions.

The bright star is 1,250,000 miles in diameterlittle less than one and one-half times as big as the Its mass is three-eighths that of the sun, and its density only one-eighth that of the latter. The fainter star is still larger, about 1,450,000 miles in diameter (or one and two-thirds times that of the sun), while its mass is but three-sixteenths, and its density only one-twenty-fifth that of the sun. The centers of the two stars are just three million miles apart, and they revolve about one another in a nearly circular orbit in 68h. 49m. The plane of the orbit is inclined

group of constellations, of which Orion is the center, filling the southeastern sky. The Pleiades are almost overhead. Below them comes the larger group of the Hyades, including the red Aldebaran. Orion is next, and then Canis Major, recognizable at once by the incomparable brilliancy of Sirius.

Below Orion are two constellations which, though

small, are fairly conspicuous, and are shown in our initial letter. Lepus, the Hare, is an ancient constella tion, mentioned by Ptolemy. Its principal configura-tion is a small quadrilateral of stars of the third and fourth magnitude directly below Orion

Columba, the Dove, which is south of this again, is a relatively modern group- being supposed to repre-sent Noah's dove, in the biblical story of the Deluge It contains one bright star of nearly the second magnitude, which may be found by carrying a line from Procyon through Sirius to an equal distance on the opposite side

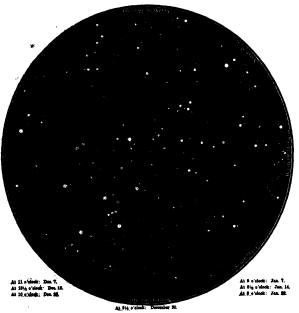
West of these is the huge extent of Eridanusa winding stream of faint Orion, and pursuing a zig-zag course down to the southern horizon and innar, its brightest star, is visible only from points below the 30th parallel of north latitude

In the eastern sky we find Gemini and Can is Minor, with Leo and Hydra rising, and Cancer, with the faint star cluster Praesepe above the latter The Great Bear is coming up in the northeast, the Dragon and the Little Bear are low in the north, and Cassiopela and Cepheus are in the northwest above Cygnus, which has nearly set. Auriga and Perseus are overhead and west of them are Aries and Andromeda. Pegasus is lower down in the west, Pisces next to the southward, and finally Cetus, setting tail first

Mercury is theoretically an evening star till the 10th, when he passes through conjunction with the sun, and becomes a morning star; but he is actually so near the sun ail through the month as to be almost invisible. Venus is an evening star, setting only about half an hour after the sun at the month's

beginning, but remaining in sight at its close till an hour and a half after sunset. Mars is morning star in Scorpio, rising about 5 A. M. He is over 200 million miles away from us, and so does not appear very bright. Jupiter is likewise a morning star, but rises much earlier—a little before 2 A. M on the 15th Saturn is the only one of the planets visible in the evening sky. He is a conspicuous object on the border of Pisces and Aries, and remains visible till a little after midnight. On the 20th he is in quadrature with the sun, and is due south at 6 P. M. Uranus is in conjunction with the sun on the 16th, and is invisible this month. Neptune is in the very opposite quarter of month. Neptune is in the very opposite quarter of the sky—being in opposition on the lith—and is visible all night long. His position on the 15th is R A 7h, 26m. 26s., Dec. + 21 deg. 18 min. 40 sec., and hys daily motions —7s. in R. A. and + 15 sec in declin-

The moon is in her first quarter at 1 A M, on the Sth, full at 5 P. M. on the 14th, in her last quarter at 1 A. M. on the 22d, and new at 5 A. M. on the 30th She is nearest us on the 12th, and farthest off on the 24th. In her circuit of the sky she passes near Venus, Uranus, and Mercury on the 1st, Saturn on the 8th, Neptune on the 14th, Jupiter on the 23rd, Mars on the 26th, Mercury again on the 28th, and Uranus on the



MIGHT SKY: DECEMBER AND JANUARY

about 7% deg. to the line joining Algol to the sun, so that the eclipse as we see it is partial, rather more than one-fourth of the diameter of the brighter star

The principal etar is about nine times as bright as the brighter side of the companion and fifteen times as bright as the fainter side. To compare these with brightness, we need to know the distance Algol, which is unfortunately so great as to be almost beyond the limit of measures

It is probable, however, that the brighter star, though of only about twice the superficial area of the aun, gives out at least fifty times as much light; while the faint companion, though long regarded as a dark body, because its light was so small a fraction of the whole, gives out at least three times as much light as the sun even on its fainter side.

It is seen for anyone to see for himself the changes in light during the principal eclipses of Algol. During the present month, minima observable in our longitude occur at 11 P. M. (Eastern Standard Time) on rum groups at M. F. M. (asserts standard 17ms) on James 1st, 8 B. M. on the 4th, 5 P. M. on the 7th, and as 40, coming th. 11m. earlier on every third night till their sea, again conveniently observable at midnight on the 2th, 3th M. on the 2th, and so on.

THE HEAVES Turning to our star chart, we find the splendid

Abstracts from Current Scientific Periodicals

department of the Scientific An able articles that appear in Fro stific information gleaned from

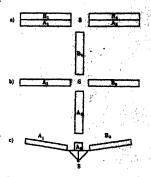
A Safety Device for Air Craft

T is self-evident that the problem of aerial travel cannot be solved simply by the construction of sels capable of carrying persons through the air at great altitudes, but that it is equally important to bring the aeronauts back to earth without injury. For, what does it profit an aeronaut, or his successors, to accumulate valuable experience if at the end of his flight he is dashed to the ground and killed? So his night he is dashed to the ground and killed? So questions Prof L. Zehnder in Umschau, and proceeds to answer himself thus: "In view of the numerous fatal accidents that have occurred in the last few weeks, I think that it would be well to offer prises for types of construction and equipment that would minimize the danger of fatal falls, and to prohibit the carrying of passengers in serial vessels of any other sort.

"Every aeroplane should be so constructed that the pilot could instantly and easily transform it into a parachute, which, however, need not have the conventional parachute form. In the case of a monoplane, for example, the wing on each side might consist of a front half, B_1 or B_2 , and a rear half, A_1 or A_2 (see Fig. a of the diagram). In flight these half wings would be coupled together so that each wing would form a single sustaining surface, but in case of accident the four half wings could, by a single movement of the pilot, be arranged in the form of a cross, as in Fig. b. (The sustaining surfaces of aeroplanes would be more efficient, for a given weight, if they were made of stiff sheet metal, instead of fiexible canvas, which, if not perfectly taut, assumes forms which greatly increase the resistance

to progression.) The change might be effected automatically by the pilot rising to his feet. The stability of the parachute thus formed would be increased by in-clining the four surfaces so that their outer ends are higher than their inner ends, as in Fig. c, where & denotes the center of gravity of the machine, motor and This arrangement would make capsizing impossible.

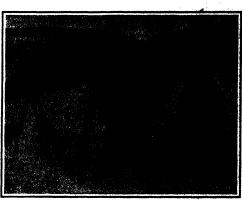
"By experiments with weighted models it would not be difficult to find a form of supporting surface and a type of construction such that the aeroplane, in falling from any flying position, would sutomati-cally assume this stable falling position. The surfaces must large enough to bring the aviator to the ground unbarmed, and the machine should be provided with clastic feet, to diminish the shock of landing. It is possible, also, to attach the motor and other heavy machinery to the aeroplane in such a manner that they could be cast loose and dropped before the ground is reached, enabling the light aeroplane-parachute, weighted



only by the pilot, to sink gently to earth, still go by its steering and eleyating rudders.

There can be no insuperable mechanical difficulty

in carrying out the scheme here outlined. It would

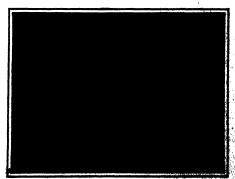


Prof. Stoermer photographing an aurora

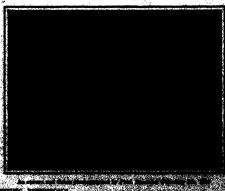
Studies of the Aurers

swill now himselfor theory of the saves in that of a Paulsen, which attributes the phenomena to the passage of cathode rays through the highly attended upper strate of the atmosphere. Estimates of the height of the aurora vary widely. Auroral streament have been seen beneath clotte and mountain autumits less than 4,000 forch high, and also in high northern than the contract of th less than 4,000 feet high, and also in high northers in plattindes above the lotty circus clouds. Dr. Albred Wegesier estimates the height to range from 70 to 400 lifemetries (4 in 250 miles). He attributes the ocaled "drappries," which seldem extend to a greater height thin 45 miles, and the other strisped forms to the shorpiton of cathode rays by an atmosphere of nitrogen, and

attributes the homogeneous bows and other forms destitute of rays, which are usually seen at a height of about 125 miles, to absorption by an atmosphere of hydrogen. Accrding to Paulsen's observations, auroras occur at all heights, from 300 miles down to the earth's sur-face. The height of an aurora can he determined by photography, althe determined by photography, al-though the motion of the bands and streamers and their feeble luminosity present great difficul-ties. Prof. Stoermer, in Unactina, narrates how he has successed in photographing surroul phenomens with exposures of less than one second. His photographs were made in February and March, 1910, at the Norwegian arctic station Bosse kop, in Finnmark, where the Ger-man, Prof. Grendel, made the first photographs of an aurora, in 1892. After experimenting with a great variety of pintes and lenses Prof. Stoermer decided to use Lumbers violet label plates and a kinemate graphic objective of 1 inch dispi (Concluded on page 21.)



----Art surges and the Great Dioner photographed by Prof. Ste



GLEANINGS FROM SCONTLING PRINCIPALITY

A Great Zoological Park New York's Remarkable Collection of Animals By Walter L. Beasley

The conceurse and north end of Baird Court. The new administration building on the left, Rockefeller fountain in center, bird house on the right, primate house in the distan

New York Zoological Parl, with its two hundeed and sixty-four scres marvelously fashloned by Nature for an ideal animal museum, presents for instruction and amusement of New York the en in any one single spot in the w This remarkable exposition contains over 5,000 living dd questures, kept together in comfortable captivity,

entitled in open-air inclosures.

Theough Director W. T. Hornsday the Ecological Theorem Director with increasing our provinces which of New York line secured from the jungles, therein, forests, and mountains of the world, their speet and most remarkable living animal treasures. in order that the millions may know them by per acquaintance, and appreciate the marthe animal kingdom.

e people of New York appreciate the effort. made by the society is shown by the attendance of visitors at the park during the last year, which by actual turnstile record rose to 1.614.953. To make a park and collection worthy of the fauna of all the sequinents of the globe, and also worthy of the metropolis of the new world, has been a gigantic task; but thanks to the wise and energetic work of Direc-tor Hernaday, and the guidance and co-operation of officers and members of the Zoological Society, the park, after three years of planning and eleven s of very strenuous work, is now practically comirse, this does not me more ever will be added, or that in the future no nts will be nece

uness imprevements will be necessary.

In Mercenber, 1889, the park (which never has been closed), was flort "opened" to the general public. The eviginal impulse and effect for the creation of the New York Zoological Society came from Mr. Madison Orapi, now the secretary and chairman of the executive committee, then a sportsmen, student of nature, and e, then a sportum ion a lawyer. Fortunately, very early in instead a -lawyer. Fortunately, very early in sey, the new empainments accured the active of Frof. Heary Fatricial Cohorn, now the st. All the specials. It is impossible to ovar-fidelinance of these two mon on the society-alling said, success. Their efforts to establish and, such to the possity, and to advance its interest statics. All the said of the said of the said the said of the said of the said of the Miller of the said of the said of the All the said of the said of the said of the All the said of the said of the said of the All the said of the said of the said of the All the said of the said of the said of the All the said of the said of the said of the All the said of the

logical Park are the property of the Zoological Society, having been presented by its members or pur-chased out of the profits of the privilege business created by the society, under the authority of its contract with the city.

A WONDERFUL ARRAY OF ANIMALS

Of the great array of noteworthy mammals, birds, and reptiles at present on exhibition in the park, many pages, or even a whole volume, would be nee to convey a fair impression of them. The collections have been formed strictly on scientific lines. Through the courtesy of Prof. Henry Fairfield Osborn, president of the society, the writer was afforded opportunities of securing some close-range photographs for ber of the most rare and interesting animals and

The collections of birds are fairly hawildering in their variety of species and general zo Over three thousand individuals representing hundreds of species, gathered from a hundred different localities are exhibited. The collection contains such feathered rarities as the California condor, haspy eagle, Bateleur eagle, trumpeter swan, whoophafpy eagle, Bateleur eagle, trumpeter swan, whoop-ing crans, sun bittery, serlems, Bouth American trumpeter, gyrfalcon, sea eagle, yellow-necked casso-wary, hyseluthino macaw, black cockatoo, black-backed pelican, ptarmigan, and a hundred smaller varieties, making its scientific value beyond question.

Among the latest arrivals are three greater birds of Paradise, from Aru Island, New Guinea, being the first live specimens ever placed on exhibition by an an institution

The mammoth Flying Cage is one of the wonders park. It repres ents an attempt to do for c tain large water birds what has been done for the

g the ice caloss in his popl GREAT ZOOLOGICAL PARE

hoofed animals and other species; that is, to give them a section of Nature's own domain. In this huge cage they can fly to and fro, build nests, and rear their young in real freedom. The cage is the summer home of a mixed flock of large and showy water birds, such as herons, egrets, fiamingoes, pelicans, and others. It is fifty-five feet in height, seventy-five feet wide, and one hundred and fifty-two feet long. It completely incloses three forest trees of very considerable size, and contains a deep pool of water a hundred feet long Among the large and rare birds of the Ostrich House is the picturesque emu from Australia, now almost extinct, and next to the ostrich the largest of existing birds. There are three species of ostriches

existing birds There are three species of catriches and four of caseowaries.

Of reptiles, 1969 in all, in charge of Curator Raymond L. Ditmars, the collection is very comprehensive. It contains king cobra, speciacied cobra, bushmaster, for de lance, puff adder, five species of rattlesnakes, five species of crocodilians, and pythons, boas, anacondas, small serpents, iguanas, turtles, tortoises, terrapins, and amphibians in great variety

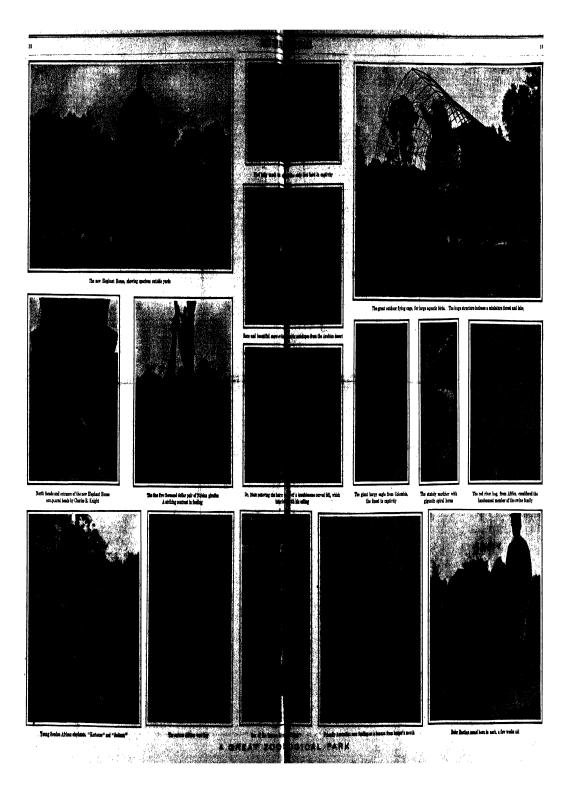
HUMANE TREATMENT OF CAPTIVE CREATURES

From the beginning, it was the aim of the Zoological Society that the park should be designed and created on lines of the most far-reaching humanity toward its captive wild creatures Therefore, the utmost of experience and the best skill that man could furnish, and ideal grounds and a fair supply of money, have been skill fully combined to render the wild animal population not only comfortable, but happy from day to day The not only comfortance, but nappy from any to casy rise spacetous outdoor yards for the exhibition and comfort of the wild creatures are one of the unrivaled features of the park The director says: "For humane mon and women there is small pleasure in the contemplation of living creatures that are in prisons, and that look and feel like prisoners, pining behind their bars. Better no soological parks and no wild animal colle tions than miserable and unhappy prisoners! A hadly made or badly kept zoological park or garden is worse than none But, at the same time, it is folly for anyone to say that all zoological gardens and parks are dens of cruelty, and is held by a few extreme humani tarians. The creatures in the collections of the Zoo logical Park give unimpeachable testimony to the contrary. If our bears or hoofed animals, our birds, our apes, and monkeys, are not positively happy, and full of enjoyment of life, then none are in this world, either captive or free. As a general proposition, our animals are not 'pining behind their prison bars.' The vast majority of them are happier, and better fed and watered, than they would be by their own efforts in . state of nature, wherein life is one continuous strug minst hunger and sudden death

Of the eleven large and important animal buildings the first class, of brick and stone, each one, except the Reptile House, is provided with an elaborate and exive series of open-air yards, in which every habi tant has, in mild weather, a daily opportunity to spend hours in the sunlight and the open air, freely exercis

ing or lying at ease in the shade.

The fourteen buildings of secondary importance are (Continued on page 19.)

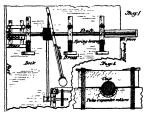


Turning a Shaft with an Emergency Lathe

By The mas Fowle

While stationed on the United States tender "Ivy," when it was anchored on the Florida reets a hundred when it was anonored on the Frontan reess standard miles from port, the writer was called upon to turn a 6-inch shaft 30 feet long. There was no lathe on board, and it was necessary to improvise one. A tool board, and it was necessary to improvise one. A tool was made out of a half-inch round file, a tool-holder out of a two-inch hexagonal nut, and a screw feed out of a 2-inch boit 12 inches long. By this means the shaft was turned a quarter inch off for a length of 4 feet.

A diagram of the apparatus used is published herewith. Several pieces of iron plate 1/2 by 3 inches were bent to the radius of the shaft, and within each threetube expander rollers were caged, forming roller bearings for the shaft. These were placed in 10 by 10-inch timbers, and braced to the deck. They served as the bottom bearings, and the caps were made of 10 by 10-inch timbers, cut to the radius of the shaft, lined with yellow metal, and held in place by means lined with yellow metal, and held in place by means of rope tightened with wooden wedges. The shaft was so long that it extended soveral feet over the star-board side. An L-piece was made fast to the deck, used as a butting block. A riece of 1-inch round steel was pointed and secured in a timber brace, to





Improved lathe for turning a shaft

serve as a lathe center on the port side of the shaft On the shaft a pulley 20 inches in diameter was rigged up. It was made of two disks of 2-inch plank mounted on the shaft and connected with 1-inch strips 2 inches wide. To fasten this pulley to the shaft so that it would cause the shaft to turn with it, a rope was passed several times around the shaft at each side and then secured to the pulley. The rope was wrapped in such direction as to bind when the pulley was revolved

There was no beiting at hand, and so a rope beit had to be used. This was wound around the pulley twice, and from there was passed about the nigger-head of the winch, where two turns were made; nead of the wingh, where two turns were masse; thence it passed up through a pulley on the end of the boom, and back again to the pulley on the shaft. By raising the boom, it was possible to tighten the rope as it atretched. The shaft was turned by running the winch.

The details of the tool holder and carriage are shown in the illustration The 2-inch bolt was suitably supported in a pair of brackets, and the hexagonal nut was mounted between them. Two metal strips were fastened with screws to two sides of the nut, so that they came together in the form of a V, with the apex arranged to slide between two rails, as shown to the best advantage in the cross The tool was fitted into a hole drilled parallel with the upper side of the hexagonal nut. It was held in place by means of a satzerew. The tool was fed along the shaft by turning the boit at each revelution of the shaft, so as to advance the nut. The entire task was completed in two days' time, and the work proved very satisfactory.

To Bend Metal Edgewise By R. T. After

Like many other proliment, that of bending metal-edgewise is simple unough "if you know how." Take a block of metal, and round it to the form you wish the metal arrip to assume. Get a greew fully with the groove deep enough to receive the metal same to



shout three-quarters of its width. Bolt or rivet this roller to a lever fulcrumed to the form block at the center from which the curved portion is struck Hold one end of the strip to the form with a lug, as shown and then, with the device held firmly in the bench vise, the lever may be operated to bend the strip about the form.

Signs of Cement By George Rice

While cement block letters have been made and used successfully since the introduction of coment articles in the commercial world, it has been only recently that there has been a practical application of the same. There has sever a practical application of the same. There is always something substantial and convincing in the rock or cement sign which has been made sa a part of the structure. Stability is added to the effect a part or the structure. Stability is anded to the effect by the fact that the sign is a part of the original edi-fice. While the coment signs can be molded as a part of the building, it is an easy matter to make the base separate and fasten it securely in place with classifing

Of course, there are well-made signs and poorlymade ones. You need not look far among the signs of this class to find evidences of poor workmanship. You will discover that the weather has had its effect prematurely on some of the signs, and that the corners are worn off and there are cracks. Sometimes the slab is brokes, due to excessive pressure of the securing is prosen, due to excessive pressure or the securing boils when the slab is based on an uneven level. Some-times the slab is fractured, due to weakness of the stock. Then there are corners broken or worn off on some of the sign slabs. You can find slabe bearing block raised letters with the edges of the letters badly worn as a result of the raine striking on them. This is due to defective work in the construction of the sign.

If the cement is poorly proportioned, with an ex-

"mud," you are going to get a shabby sign.





as is going to cling m of the mold, then you are go sharply. The stuff will be and be appatch and work with the frame, he Sometimes the max to the dry, and a made that may crack and b

CHARLES OF THE

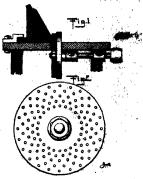
the drawing, if an ill light shining on the very striking effect.

Cutter for Strawi My J. W. Bug

The accompanying illustra The accompanying Illustrations of the confidence of their san be made for story pulpy substances. Fig. 1 shows the content of the content of

The cutter consists of a best or act tron, manufol on an arbon, su

cast iron, meassed on an arbor, suggested in bearings, like a circular saw, I, sie he shoe if are drilled a number of holes, say shoets % etter, into which are driven places of twee jocting about ½ facility and places of twee jocting about ½ facility as a circular guide in front of the cuttier hand, into which seem board, placed at an angie therethy empiric moved transversaly to the shelf or latter. board can be made adjustable, so the



As the cutter head is run may be obtained. As the cutter, beed is running full speed the atrawbeard to be brewind is either h-or clamped to the guide board, and moved in a twi-verse direction thereto. The beeth of the cutter h-will then cut a very smooth howel on the doft sur-board. The ends of the teeth speet not necessarily of even length at the start, but will soon wear or

Hints for the Handy I

Here is a bandy little kink for a universe, or for one who would

an the die treated in

THE RESERVE OF THE PROPERTY OF

in hered through a disk of glass life is follows: It was intended lines are copper tuhing 2% inches in cutaide, but there being no state hand, a wooden ying 113/15 at hand, a wooden yang turned up, and tuches long The turned up, and et copper was bent around the "Within the close topper was bent around the manufacture of the the copper projected over a state of the copper projected over a state of the copper projected out and direct state the ping. Through the limits of higher long and % inch thick a hole using himse, choicin to permit the ping to turn in the limit of the board concentration of the limits of the long of the limit of the the hole was cut, using the board as a guide for the plug, and a brace to turn it. This worked fairly well, but with dry sinery better progress was made. Care was taken not to lear down hard, nor to turn fast, for test of generating too much heat. The plate was cut through in twenty minutes.

How to Clean a Hole While Boring

When being a bole, the cuttings trequently clog around the bar and cause it to cut large, especially when the bar is nearly as large as the whole. The cuttings fall to the bottom of hole, and jam against the bar free difficulty can be evercome by wind-ing a piece of copper around the bar spirally as shown. Of course, the wire is to be wound in a right or left-hand spiral, according to the direction in which the bar is to run

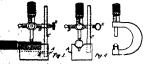
After the coil is wrapped around the bering bar, a little solder is dropped on the wire at intervals of one inch along the spiral, so as to prevent the wire from the spiral, so as to prevent the wire from coming off. In use the wire will convey the chips from the bottom of the hole to the top. A bar fixed in this way will be found very handy for boring blind holes.

Hardy Micrometer Tools By H. D. Chapman

I have found the tool shown bare in Fig. 1 of great service when measuring the depth and angles of threads. As I have not seen anything like that in any of the mechanicsi magasines, it has occurred to me it may be of some service to our friends interested in

the gage line.

A V-block A is made of machine steel and ground to 45 degrees. A hole B is drilled in one side of the Vs, and into it is driven the rod C. A cross rod D. which carries the micrometer barrel, has a hole drilled in one end, affording a sliding fit on the rod C. A the micrometer in the center of the V-block. When this tool is to be used, we will say to measure a %. inch thread gage, the micrometer is adjusted to the zero line, and a %-lach plug is laid in the V-block, and the cross red D is dropped down until the point of the micrometer touches the gage. Then the thread gage is put in the V-block and the micrometer is acrewed



until it touches the bottom of the thread, as n Brigs. 1. The micrometer is adjusted to suit first of thread, depending upon whatever kind from the bear of the suit of the suit of the first of the suit of the suit of the suit of the first of the suit of the suit of the suit of the first of the suit of the suit of the suit of the thread of the suit of

savil of the micrometer lies square and this prevents the savil of the See, said this prevents the savel of the fonce mention fined in the save of a raphic, separatible to use the characteristic as a long states the vary or which a ball bearing. This a contact place of bream about 5/18 makes his death as the characteristic and definite account of the makes had definite account of the make had defined over the savel of the long a weather in the same of the martin of the long a weather in the same of the martin of the long as well as the same of the long as the same of the long as well as the same of the long as well as the same of the long as well as the same the long the long as well as the same of the long as well as the long as well as the long as well as the long as the long as well as the long as the long

How to Compute the Velocity of a Bullet

By Frederick B. Gilbert
The velocity of a rifle bullet is found by means of a large wooden pendulum, against which the bullet is fired, and the displacement of the pendulum measured The pendulum, as illustrated, consists of a block of wood about 8 x 12 x 12 inches, from the middle of one side of which a long board, say 4 inches x 3 feet, projects horisontally. If the rifle to be used is a heavy one, it may be advisable to insert a block of iron in the wood,



owing the vertical lift!

to prevent the builet from passing all the way through.

About in the middle of the board is attached a lug, which presses against a slider on a scale. The block and the bar are suspended as shown in the figure by two fine wires, which loop through hooks and are fast-ened to the ceiling or a support, allowing about one foot between the two lengths of each wire, to prevent teral movement of the pendulum

Before setting up the apparatus, the pendulum and the bullet must first be carefully weighed. Then the pendulum being suspended so that it is horizontal, the ical length of the wires must be measured. sider and the scale are placed underpeath, so that the slider is just in contact with the lug, and the reading on the scale noted.

In placing the gun in position, care should be taken to see that it is at a sufficient distance away from the pendulum to keep the sudden rush of gases which fol-low the bullet from acting on the face of the block. The bullet must strike directly in the middle of the block, and the axes of the gun and of the pendulum must be parallel Fire the gun several times, observing the displacement of the slider each time, and finally averaging the results.

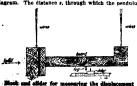
Before computing the velocity from the data, let us first consider what has happened. The bullet with a mass, m, moving with a velocity, v, strikes the pendulum, and burying itself in it, causes it to move with By the law for momentum, the moit as one body. mentum of the bullet is equal to the product of its mass and velocity, mv, and the momentum of the pendulum is equal to the product of its mass, M. plus pendulum is equal to the product or its mass, M, plus the mass of the bullet, m, and the velocity of the pendulum Y, i. e. (m+M) Y. Now, according to the principle of the Conservation of Momentum, (M+m)Y = mv,

that is, the two momentums are equal.

$$V(M+m)$$
Transposing, $v = \frac{V(M+m)}{m}$ (1)

From this equation we are able to calculate v if v We know M and m already, it can find V, M, and m. but remains to find V

This may be determi ned by a consideration of the diagram. The distance s, through which the pendulum



g wither the association of gravity, or 32.2 feet per second, or 100 consumers per second. The value of c, as many resignily be seen from the figure, is determined by the frieights. c=!-/P-#

e as if the velocity V were vertically

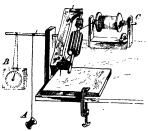
(8)

may use the familiar formula

I being the vertical length of the wires measured d the displacement of the slider. Solving formula (2) for V, and substituting the proper values in (1), the velocity is determined in feet or centimeters per second. Care should be taken to employ the same units of measure throughout,

Suggestions for Rewinding Armatures By A. F. Bishop

A swivel holder for rewinding magneto armatures may be made as follows: Saw out a yoke-shaped piece of wood % inch thick, and long enough to carry the armature, as in the illustration. Cut a half-round groove in each end for the armature shaft to rest in.
Make two saw cuts in each end of the yoke to receive
the string with which the armature is bound to the A small 4-inch rod is driven into the center of the yoke This journal fits tightly in the hole of an upright piece that is fastened to the base necessary to have an indicator to register the number of wire when winding an armature of thread attached to the voke fournal, and allowed to wind as the armature revolves, is a simple method of



Swivel holder for rewinding magneto armatures

keeping count. But if one is to wind several tures, it is better to rig something a little better, which is made by taking the works of an old clock, attaching a paper dial and pointer, and revolving this by means of a very small cord or belt, which should run over a small pulley on the escapement wheel shaft, as shown by dotted lines in the drawing. The reel for as shown by dotted lines in the drawing. The rest for holding the wire, which should have a resistance on its centers to give a good tension on the wire, is easily arranged as indicated in the illustration.

Casts Made with the Electric Arc By G. Worts

Owing to the great amount of heat that is developed in any form of the electric arc, it has been commer-silicon and such products, it is found invaluable. A method is suggested below for making small casts in which the electric arc is used as the heat source. in brass, zinc, aluminium, silver, gold, etc., can be



Making a cast with the electric arc

made. Preparations for the casting should be made in the ordinary manner. Form the mold of sand or plaster as advisable, and then over the pour hole place should have a round tapering hole, the small end of which opens above the pour hole of the mold. A terminal should be bolted to one side of the carbon b and lead to the current source through a series of heavy resistances. The carbon slab comprises one electrode of the arc, the other being a % inch hard

round carbon fitted with a fiber or wood handle

& small block of the metal to be melted is placed in the depression of the carbon surface, and touched by the other electrods to form an are. The metal will flow into the moid quickly, dependent on the amount of current supplied to the arc Casts obtained by this method are very smooth and regular. It is necessary to wear a hood fitted with dense blue lenses, or the fumes and dazzling light will prove detrimental to the operator's lungs and eyesight.

The Inventor's Department

Simple Patent Law: Patent Office News: Inventions New and Interesting

The Professional Inventor By Joseph B. Baker

THE old-time inventor did his work as an individual, carving fame and fortune in new fields. But the vast growth of manufacturing has changed the status of the inventive art, whereby individual eleverness has been largely replaced, and is always supplemented definite engineering work performed by a corps of men.

Many of the large manufacturing companies now employ men for their actual or probable inventive ability. Not only the personnel of the research laboratories of these concerns, men who are specifically employed and paid to invent, but department heads and engineers out the plant are expected to give thought to the getting up of new ma-chines, devices, arts, or processes, or to the improvement of existing ones, and required to assign their inventions ment which is to the company. Nowadays a detail improvement in some feature of the work. made perhaps by a foreman or operative simple change which saves time or labor or material-may be more important in direct money value than a primary invention of former times.

The actual working of the inventions department idea may be illustrated by a department idea may be illustrated by a of costs, but few facts from the experience of one the meeting of few facts from the experience of one the meeting of of the large electrical manufacturing, very pressing companies. In 1908, out of the 20,000 problems inci-men employed at the principal works of dient to the this concern, about eight hundred, from all over the factory, constituted the in-vaniting staff.

The contract of each of these men called for the assignment of all of his invenof one dollar and his employment by the company." The salaries paid ranged from \$2,000 to \$10,000. The sum of \$2. 500,000 a year was being spent in fostering and patenting the development work of these men; supplying the tools, appliances, and materials, paying all the bilis for drafting, experimental work, and model making, and getting out the

In the year stated about six hundred ideas, out of 1,400 that had been disclosed by a number of these men, were considered valuable enough to be patent-A considerable legal staff is em-

ployed to take care of the Patent Office work of the company The manufacturing methods that are followed in getting out the regular prodrevail also in the development of new devices, from the preliminary sketches to the drawing up of one or more patent applications and the appropriation for the manufacture of a small trial lot of the device for general sale. The research laboratories cost about \$75,000 year to run, although the bulk of their work is pure science, furnishing a groundwork only for the making of specific improvements.

Another instance is the National Electric Lamp Association, consisting at present of twenty-three lamp-manufac-turing companies The principal activity of the ass tion is in an engineering department, which spends \$350,000g annually and employs a staff of 150 men in three divisions — research, technical engineering, and commercial engineering. In the research division the yearly cost of an hundreds of inventive workers. It the physical laboratory alone is estimated has been in inventions departments—the at \$25,000; and this laboratory is unique laboratories of the Bell and independent among commercial inventions depart-ments in that all of its findings are regiven to the world at large.

The modern telephone ser vice is an example of the application of engineer. methods in the development of a complete system, in contrast to the work of the early, individu a ! inventors the art of telephony. In this developobject was not primarily the

growth of the business

the object stated certainly could not have been served but for the co-ordinate work of a great inventive staff.

A practical working apparatus for transmitting the spoken word over an electric wire was produced by the inventive labors of Bell, Gray, Edison, Berventive labors of Bell, Gray, Edison, Bar-liner, and others, but this achievement was only the beginning To make the "scientific toy" which Sir William Thom-son saw and heard at the Philadelphia Centennial in 1876 the basis of the pres-ent vast network of telephone communi-

It years, improve telephone manufacturing companies, and the maintenance departments and repair ported to the proper scientific bodies and shops of the local operating companies that the multitudinous devices required

James W. Gayley, an ex-vice-pres Steel Company esident of the U. S.

His dry-blast air process is saving hundreds of thousands of dollars

history of the fact of the property of the samples of 190's, of the "solid-back" transmitter, middidual inventions of high order, but universally used, which made long-d in the early universally used, which made long-dis universally used, which made long-dis-tance working possible, the limits set to talking distance by the properties of ex-isting lines presented a new set of prob-lems. To render the long-distance lines more efficient and enable longer distances to be covered called for two sepa rate campaigns of investigation, is which groups of telephone inventors in the several experimental organisations vied with each other to produce a prac tical telephone relay or repeater, and to improve and standardize metallic-circuit copper-wire lines. The prosecution of

into practical operation to meet need for them and serving as app

generally, for all to try to improve upon. The organized researches on thase two lines resulted in many useful inventions made by the way. Among the early results of the work wate the introduction of hard-drawn copper wire of randardized diameter and physical and electrical properties, and standardized pole-line construction designed, 89 withstand high wind pressure; in winter when the wires are loaded with ice, and finducting transpositions to avoid "induction" and "created at the winds of the for making the telephone of practical use have been worked out. The experts of the three or four large corporawhich demanded the putting of all wires manufac. ture or operate underground, the cable conferences that resulted in the standardisation of paper the bulk of the telephone cables exemplified the tear the country work method of attacking difficulties. The have met and solved the electrostatic capacity and high insulation resistance of dry air, secured by dry paper loosely laid up between the two conductors of each "twisted pair" in problems inci-dent to the vast extension the hermetically sealed lead cable sheath, was embodied in various cable construcof the service was embound in various cable countries tions evolved by as many different groups of men. These different plans became the basis of "conference cable" specificaby aggregative organised efforts--experithe basis of "conterence cause spersum-tions, under which cables were manufac-tured for use by every telephone operat-ing company in the field.

Meanwhile the army of workers on based on exsearch in pure physics and mathematics.

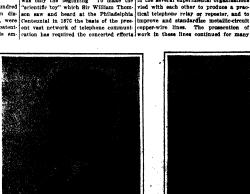
at the common disposal of tele

switchboard and operating and traffic problems had not been idle. Out of the necessities arising from the phenomen-ally rapid growth of the service in the In the Rell organization, following large cities, with its incidental probl of prompt and economical handling of local and long-distance calls, saving of floor space occupied by switchboards, elimination of local battery inspection, etc., grew up the modern "common bat-tery system," with its simplified telephone sets at subscribers' stations, lamp-signal switchboards, and highly organized operating methods—the work of many men, each of whom contributed his effort in the improvement of some feature of

> The telephone system of to-day is repsands of patents, the great majority of which are for detail devices. To a single individual employed by the Western Electric Company—Mr. Scribner—over hundred patents have

issued, mainly on switchboard and substation devices: his work has been that of an extraordinarily prolific inventing engineer, in touch from the first inception of very device with the work own ssaistants and members of other experimental staffs an inventor of the old school.

The inventions department that has built up the telephone service was called into



J. J. Carty, a telephone engineer where in done much to improve the teleph



Creater -In orde tream his trousers d without removing an electric pressing from educted slide on a vertical guide rod. The d for the operator's foot, and a



be held steady. The pressing iron consists of two spring-pressed, electrically-heated plates; between which the material to be creased is placed. The iron is furnished with current tapped from a lamp socket by means of an ordinary plug and connecting wires

Support for Automatic Guna. —To fa-cillate the firing of heavy automatic guns, a support has been invested, which is illustrated herewith. A pair of legs are fitted to the barrel of the gun, while the stock of the gun rests on a movable support consisting of a shank fitted with a roller that travels in an arcuate groove formed in a base plate or shoe. The shoe is rested on the ground, and the proper elevation of the stock may be



Support for Automatic Game

ans of screw adjustmen on the shank of the support This screw adjustment may be thrown out at a moant's notice, permitting the gun to be elevated or depressed at once to approxi-mately the desired position. The screw, however, permits of careful adjustment In use, the stock of is held against the shoulder as shown.

Whip-Socket Lock -- Whips are so fre quently and easily stolen, that an in-ventor has suggested a simple but efventor has suggested a simple out effective means of making them fast in the socket when they are not in une A holder encircles the whip, but is not large enough to pass over the butt of the whip. A shank on this holder ex-tends downwardly into a hellow sheath adjacent to the whip socket, and a pad-



Brief Notes on Inventions Filtering Clear Smoke.—For the purpose of filtering the smoke of a clear, a widespread idea that one has a right to small cartridge has been devised, commands a patented invention without the sisting of a layer of blotting paper and consent of the patentee, for his personal one of cotton texture rolled up into a small cylinder covered with waterproof paper. This may either be inserted into the cigar, or else be embodied in it dur-ing the process of manufacture.

are, in many instances, made of a special design, and indicate the make of the car so long as the car is standing still Cannot some one invent a wheel hub that will be distinctive in its appearance, and will be distinctive in its appearance, and will present the same distinctive appearance the car be at all times, whether the car be standing still or moving?

Korean Patenta. -- Imperial ordinances have been passed relating to the protec-tion of industrial property in Japan and Korea under the treaty of annexation The ordinances decree that all patents trade marks, etc., in effect in Japan on August 29th, 1910, became effective throughout the kingdom of Korea on that date. The provisions of all patents, trade marks, etc., granted by the Japanese government since August 29th, 1910, will, generally speaking, extend to and throughout the kingdom of Korea.

Counting Eggs as They Are Laid.—A Buffalo man has patented an egg mark-ing device which is described as "adapted to be attached to a hen to mark the eggs as they are being laid." The pur-pose is to ascertain the laving capacities or qualities of a hen by marking each egg as it is laid and this is accomplished by a device attached to the hen itself. Securing rings, apparently of metal, are passed through the cartilaginous pe of the hen and co-operate with spring devices in securing the marking devices in position on the hen so that as the brought into position to produce on the egg the distinctive mark appropriated to the particular hen The patent was issued in Santamber 1910 sued in September, 1910.

guiding arrangements for halloons by living motors in the form of hirds such as easies, valuers, condoor, etc. which he proposed to harvess to a balloon "in such passing as to leave their wings in ported liberty," mean's being provided so that the operator on an direct the flight of the birds to propel and steer the balloon. Another investor, feathal of fire, incorring the steer of the birds to propel and steer the balloon. Another investor, feathal of fire, incorring the steer of the bords order are the steer of the the cord, neighbb that in case of the the cord, neighbb that in the window state of the cord, neighbb that it is not the cord of th

Legal Notes

consent of the patentee, for his personal use only, and not for sale to others. This is entirely incorrect. The patent law grants to the patentee and those holding under him the exclusive right This is entirely incorrect. The patent law grants to the patentee and those holding under him the acclusive right to the manufacture, use, and sale of the wind the manufacture, use, and sale of the formation around invention. No one has a right sace the opposite idea of the vanny or fosting to make a patented thing for his own, and thereby form a positive toke at the junction use. As a matter of fact, it has been of the quarters with the vanny or fosting abed an inferiperement to make a patented the cat.

patented invention. No one has a right to make a patented thing for his own use. As a matter of fact, it has been held an infringement to make a patented article, although it was never used by the maker. The courts have gone so far as to hold that a device constructed originally not to infringe, but with the intent that by the wearing of its parts it should become an infringement, is an infringement.

infringement.

X-Ray Pridence.—An entirely new use bas been found for the X-ray machine, namely, in acquiring evidence The case was that of Browder versus Commonwealth, 123 Southwestern Reporter, 328 a heary own on trial for shooting and killing a white man. He did not deapy the shooting, but claimed he shot in self-defense. The deceased after the shooting but claimed he shot in self-dig had a pistol. Defending claimed that he had been shot in the breast by which was the beginning of TELEGRAFH SENDING-MACHINE. — J. If TELEGRAFH SENDING-MACHINE. — TELEGRAFH SEND the difficulty. It would necessarily fol-low that if defendant was shot, and if he could affirmatively prove it, then a case of self-defense would be clearly established. Accused moved for a continure in order that he might be examined with the X-ray by a physicion to show that he was shot in the breast and that the bullet had lodged in his back. The court on appeal held that defendant on return of the case might be taken from jail to an X-ray machine and examined; for this fact, if proved, would strengthen his testimony as to what occurred at the time of the homicide.

CF INTEREST TO FARMENS
Bleached Flour Process Illegal.—
Shawnee Milling Company versus Templo, 179 Federal Reporter, 517, is a suttered to improvements in derives for stacking
in equity to restrain cortain United states officials from selsing compainstates officials from selsing compainant's flour in interstate shipments under generations, and with a sense reportions, the control of the mattonal pure food law. The allegaof labor. the particular form 1 in patient was its lead of the process. Billed Operating Device Needed—obtained billed of the process and the third of the patient was its lead by a process, and that there is always without disturbing the acreens. An arthough the objective was builded and of the purpose of the port of the process and that there is a deposite the national pure of the port of the purpose o court heat that this process is illegal and comes under the ban of the pure food law. The court also passed upon the constitutionsiity of the sot declared it willd, and held that the efficials had acted within the scope of their authority

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

PERTAINING TO APPAREL

the back seam.

METHOD FOR FORMING SHANKS FOR BOOTS AND SHOES 1 50 METHOD FOR FORMING SHANES FOR BOOTS AND SHOES 2. Daynesse, Toronto, Canada The Invention has reference to bound and shoes, and provides a method of producing shanks for the same from landnated wood in a very simple and conomical manner, the shant produced not height failed to shrink, swell, check or split, and will retain its shape.

adapted to ride

TELEGRAPH SENDING-MACHINE, -J II
JONES, FORT Arthui, Ontario, Canada An obthe dish discretion is to provide a device of
the original construction, which may be varied
in the pocket, and which may be inserted in
place of the heer of an ordinary telegraph, key
by simply removing the latter from its pivotal
supports.

supports.

MIGNALING APPARATUS G II. CAPOIIIREAN, Ketchikan, Alaska The main purpose in
this case is to provible an chetical apparatus
which will do kway with the bubit in common
use by so placing a receiver and a transmitter
that the cose acts on the other to produce a
whilsting or howling sound which can be used
for the signal.

OF GENERAL INTEREST

WINDOW-SILL, G. H. GERAPHOTS, New York, N. Y. An object in this instance is to pro-vide a sill preferably made of cement, or other concentrious material, and arranged for sup-(Continued on next page)

primate URINAL—W. 8 Ross, New York, N Y in this improvement use is made of a receptacle having a flat bettom, converging in the property of th

wardly.

TOBACCO-DIPE.—A. Q. WALSH, New York,
N. Y. This inventor provides the pipe with a
suspending and supporting device or frag,
which is hinged to sering into a convenient
position for use, and is adapted to fold agnish
and conform to the pipe and form a portion
of the pipe frimming when it is to be disposed independitude.

posed independively.

BENTAL APPLIANCE—I. G. Monian. East trange, N. J. In this case the investion refers to dential appliances, the more perticular purpose being to provide the more perticular purpose being to provide the for exerting a gentification in provident the a direction can be applied to the provident personnel and the provident provi

dentist.

\$11 HON.—L Riggs, Summithill, Pa The
aim here is to provide a siphon by means of
which fluids of different kinds can be drawn

and the different block on the stream from vessels or other containers, in accordance with the well-known principle of the siphon in which the accumulation of air within the siphon tube in prevented, and which is continuous and certain in operation

AIVERTISINO DEVICE.—P C. SCUTT.

CAUGHI BHIRS, lown. In this instance the invention produces a device for use in street cars, or in public places, which will display an advertisement or a section of residing matter of time, and will then replace it by another of time, and will then replace it by another advertisement or section of residing matter.

PAPINE, PLES SCREEN.—II & SERVEN.—II & SERVEN.

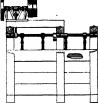
advertisement or section of reading matter.

PAPER-PLUS PREEN.—II. E SPANNO and
W. H. LOCKWOMD, Fitchburg, Mass. The Invention has reference to paper pulp screen, and
It has for its purpose the provision of plates
with aboultiers below in Lapering zeroors, with
which a wedge member is adapted to exgagto clamp them together, guides being provided
for the wedge members.

for the wedge members.

OPERATION MECHANISM FOR ORE JIGS

--WILLIAM A BRADLEY, Bight, Newada. An improvement in gearing used in one Jigs is provided by this invention. It consists of a plirrality of locking shafts provided with imports
and connected together by times and cranks



OPPRATING MECHANISM FOR ORE JIGS.

in such manner that the shafts rock in opposite directions, one group of tappets being raised while another group is lowered the tappets playing upon plunger rods which are connected with the plungers for agitating the ore and the liquids with which the ore is mixed

liquids with which the ore is inked CUPF ATTACHMENT—F. However and J. J. SMIROL, Box 541, Honolulu, Hawall. In order to ieduce the laundry bills of the man who is accustomed to making notes on his coffs, a simple memorandum table! and a bet-ter surface has been provided which may be



CUFF MEMORANDUM TABLET.

used with the ordinary cull it comprises a support arranged between the cull and the sheep, normality concealed from yew. This may be moved out when desired, and it carries a sheet of material upon which memorands may be jotted down, and from which the writing may be erased without injury to the sheet. COMBINED PAPERING BOARD AND SCAPPOILD—Or II Tanns, Woodhawn, Pa. Mr Thier's invention has reference to papering boards and considering house, and it has for its reported and the same of the property of the provinces of the property of the provinces to a basic form of the provinces of the province

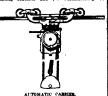
port at the ends only, so that the middle poertion is unareported, and hence the windler
at its not links to crack in case the building
settler.

W. Chai, Guiller M. Horsen, T. E. Thanks and
N. To this improvement has is made of a
receptacle having a flat bettem, converging
a proper notion of a picker stick without retions on inclined too having its front edge.



of adjusting the sweep stick relative to the pictor stick, according to the power to be given to the picker active. According to the power to be given to the picker active for seading the shuttle through the open shed with more or less force. The sweep sitch has a loop for engagement with the picker stick has a loop for engagement with the picker stick has a top for engagement with the picker stick has a loop for engagement to the loop end of the picker stick.

AUTOMATIC CARRIER.—M. H. Cawuzz, 687 Jefferons Street, N. E., Minnapolis, Minn. The hoist illustrated in the accompanying engagement is adopted particularly for the one of builders, but it may be used to advantage it. vontiates means for looking the carrier at hoisting stations and for automatically re-



loasing it. Adjustable devices are provided for regulating the height to which the load may be resired, and a system of temporary auto-matic reiesaing and holding devices may be located at instremediate stations of the carrier track. Owing to a swivel connection between the carrier and the holating devices. the car-rier may be operated at different angles from the source of power.

PERTAINING TO VEHICLES

VEHICLE WHEBL.—Oscar Tarres, 850 Bas; 195th Street, New York With a riew to designing a wheel for automobiles and similar vehicles, which will be proof against puncture. Mr Treler has invented the construction illustrated herewith, which employs an outer



the of solid rubber, boiled at intervals to manget treed pitters. These its term, rest on posemantic harbors soated in the size rest on posemantic harbors soated in the size of the whost. The chambers are located in telescoping compartments and are connected by means of a table common to them all see that they may be theirted guintlementally become the size of the tree of the size of the size of the size of the law formshord by the Scientific Amagican for the contraded by the Scientific Amagican for en come can. Prises state they aspise of the partners, title of the inventors, and date of this paper.

Military Value of the Control of the Notes and Queries.

Einely write queries an espatale shorts when writing the short mattern, such as passeds, inchespetiting books, no. This will facilitate showering part of these. In ours and give full mass and although one or way

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Full hints to correspondents were urineed as 180 head of this folium in the sens of June 1804, 1900, or will be sent by mail on request.

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(12843) R. O. W. 18tyr: I wish to have been by small or following apportunity. A load with result of following apportunity in the sense of the sense of

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figures are available giving the percentage of difference.

(12244) W. E. S. says: Planae say what is the difference between a series and a saunt wound sherrier motor, and deserting the same of the current flows through both field and armature before it comes gut of the machine. In a shunt-wound machine the ends of the same of t

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Show Kyura, My Bobert Cortmanns, M.S.

New Treet: The Journals of Replete
Publishing Company, 1931.

Mr. Orienshaw, the author of this book, is a
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an accolinat index, which facilitative the hand-ing of his book.

Ferracia. By Chagins Ethory Mann and
George Ranson Twins. Chicago:
Scott, Forceman & Co., 1916.

This look is written according to a method
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source of problem. Of recent years the
method has come to be recognised as one of
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EXTERN MOTHERM AND CREATURES OF THE PROPERTY MOTHERM DAYS. By Rev. H. N. Ruichtseon, B.A. Lordon: Chapman & Field, Ltd., 1910.

This is the second and enlarged edition of a work which has deservedly carred on tendence of the province of the property of t

CHOIC DOT THE CO.

sta foest and House for Wild maximals and birds, if any very simborate and costly; as the Boar Dete and the Flying of all the thetty buildings in the to an as the rest input of the second of the open space midway between the

In effect it connects the two great come of installations of the northern of monthern regions of the park, which and morthern regions of the park, which increasings, have been slightly separated. If he agencious, well lightled, becutiful in his links, both extrarnally and internally. The England House, unlike all other halffligs in the park, is entered at the confige of sech side, instead of at each side, it is built entirely of stone, having a main root of green titles, and a bloty come covered with glased tiles, laid in sa elaborate colored pattern of browns and greens. The dome is finally sur-mounted by a lantern of tile work, the in selors. Excepting the dome, the whole rior structure is of smoothly dressed Indiana limestone. Each of the eight incisma inmestone, sand or the signi-orages is 20 x 24 feet, and the lighting is quite perfect. The Elephant House con-tains a fine and valuable collection, consisting of two Indian elephants, two Sou dan African elephants, one Congo African elephant, one great Indian rhinoceros, segment, one great mann removers, one hippo-potations, two American tagins, and one indian tagir. The hippopotamus, son of this tamous "Caliph," now six years old, hern in the Contral Park menageric and ners in the Course Park menageric and purchased for three thoused dellars, is the chief attraction, for besides his com-fortable lounging and sleeping room, he is provided with a luxuriant bathing pool.

THE COLLECTION OF AMERICAN MAMMALS

Of North American mammals exhibited, the carnivorous species are very numer-First in importance comes a fine m of bears. It is natural that people should desire first of all to become well acquainted with the wild life of their own land. The great bear collection is installed in a series of large open-air is, having clean yards, plenty of sunlight, fresh-water bathing pools, rocks to climb upon, companionship, with a plen-tiful supply of good food. The animals equently full of action, and provide a great amount of amusement for the people

From the beginning, the park has striven to bring together as many as possible of the species of bears with possible of the species of bears with which the public is fittle acquainted. First, special attention was devoted to the Alaskan brown bears, and to-day the park possesses five species—the Kadiak, ula, Yakutat, Admiralty, and one The as yet undetermined species other. The as yet undetermined species came from next of the Arrotic orice, only three hindsed inities south of Point Barriow (the size method; point of Alanka), which is the most mertherly habitat for a bear of this group. The magnificent incursive "time" (Torice yeags) from the disable. Pentinuite is the rival of the lightly in the point of the lightly and be initially than the degree polar pear some small, "Issue the total transition of the lightly and be initially than the degree polar pear some small, "Issue wheneve and from the colessal initial than the degree of the lightly and the pear the colessal initial and the lightly and the pear of the lightly and the pear of the lightly and the pear of the lightly and the pi and caves, is consid light in the world.

A new and noteworthy exhibit is the herd of five young musk-ox calves re m Wilson cently received fre Greenland, the gift of Paul J. Rainey. "Miss Meiville," the first specimen, arrived a year ago from Melville Island. These six constitute the only live herd of these rare animals in captivity.

ANIMALS FROM ASIA AND AFRICA.

The wild-animal representatives from Asia are second only to those of Africa in size and scological richness. The prisspecimen from Asia is the great Indian "rhino," considered one of the greatest cological wonders left alive upon this earth. Conspicuous also is the Indian elephant, the Malay tapir, half black and half white; the big, hairy, double-humped bactrian camel, with its baby male, born this year. Of the wild equines of Asia, there are three important species, the Projevalsky horse (breeding here), kiang of Tibet, and the Persian wild ass. Asia furnishes a number of species of mountain sheep and the ibex. The Persian ibex is exhibited in the park, and is thriving. The long-haired, wind-blown tahr of the Himalayas is the hardiest of all the mountain animals of Asia, that has been attempted to acclimate here. One of the most showy of the wild white mountain goats of the world, with gigantic spiral horns, is the markhor, fre ing great elevations in the Himalayas of India. Of the Asiatic antelopes, the park s three of the rare and beautiful possesses three of the fare and seattlets snow-white beatrix from the Arabian desert, the very large but well-nigh horn-less nilgai of India, the beautiful little Dorcas gaselie of Arabia, and the Indian manelle of the plains of northern India. Of the many carnivores of Asia, the snow leopard is the rarest of the larger

forms, and also the most beautiful. Next in rarity and beauty also is the clouded

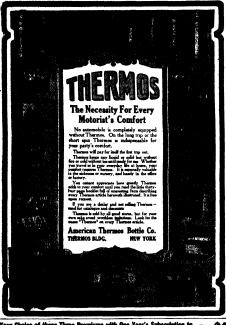
tinent best supplied with bears. There are exhibited six species. These are the Himalayan black bear, the hairy-eared bear from central Asia, the Malay sun bear, the Japanese black bear, the great Yeso bear of Japan, and buff-colored Syrian bear from Asia Minor.

Zoologically, Africa contributes the greatest number of species of commanding importance. The wild representatives of the Dark Continent in themselves form a highly impressive carayan. These include a pair of Soudan elephants with enormous ears, the pigmy west African elopant of the French Congo, a pair of black rhinoceroses, a hippopotamus, a warthog and the Red River hog, the latter being the only "beautiful" swine species in the world. Of the wild equines, there is the mountain sebra, rarest of all anecies (only 400 now alive); the Grevy sebra, one of the largest, and in some ways the most remarkable, the Grant

sebra and Chapman's.

The antelopes include a fine male sable antelope, a greater kudu, and Baker's roan antelope, three species of great rarity and value, and the cland, largest of all African antelopes. Among the other rare antelopes are the lechee, the other rare antelopes are the lectice, the addax, the belsa, Congo sitatunga, Speake's sitatunga, bontebok, blesbok, and rendunca. The only specimen rep-resenting the group of Dulker antelopes resenting the group of Duker antelopes was presented by ex-President Roosevelt. Among the commanding African mam-mais are the fine pair of Nubian giraffes from German Best Africa. They cost \$5,500. The mule stands fourteen feet six inches in height, and the female over twelve feet. The pair form the most imposing figures of the Antelope House.

Now that the fice ogical-Park is practically complete, the society dealers to earry on more Plastrous and extensive work in the protection of the fact-vanishfag wild life and the promotion spology. Among the imperiment question to taken up to that, of proventing the interesting of our, many faction to the taken up to the taken of taken of the taken of tak ting the







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SPECIAL MOTICE: On require on will nind year or list of contents of the 1910 reduces, a list of contents of the part of the pa

CHIMA CO. L. PARA

An endowment fund of \$1.000.000 in to be maked, which will 'emable the species,' is do effective work in this 'field,' Aissaid much work has been done in the master of game refuges. Through this offering the society has been instrumental in the section and the window of the work of

The Professional Inventor

(Continued from page 18.) on a large scale. During an earlier period of the country's history. Pennsylvania and Ohio were the great iron-pro-ducing States, and plants for smelting ducing States, and plants for smelting iron ore were established there, adjacent to the mines. With the depletion of these ore beds and the opening up of other and richer deposits elsewhere, notably in the Lake Superior region, it became necessary to bring in larger and larger amounts of ore from long distances; and by reason of the increased dost of the de-livered ore, the smelting plants in the old territory became threatened with extinction. To save this situation, the in ventive labors of a group of men were applied to the economical shipment and handling of the ore en route from the new fields. At the water terminals on the Great Lakes enormous electric-motor operated ore-handling plants were erect operated distances plants were erect-ed, capable of transhipping the cargo of an arriving vessel (itself especially built to be an integral part of the system) into freight cars in a marvelously short time with the minimum amount of labor Inventive talent here was distinctly no of the old, single-handed kind, bent or the old, single-handed kind, bent merely on "making an invention": on the contrary, it was of a higher order, in that it directed a maeterly campaign to build up a new system for saving on cost of delivery of ore, reducing the cost of handling the ore from 40 cents a ton by the old hand method to less than 4 cents, including interest and depreciation on plant. Its accomplishment was a ventions which revived one of the great Buckeye States.

In one type of ore-handling plant, a steel structure in erected at the water side, with accopbucket granes carried by traveling bridges and working direct upon the earge through numerous large hatches in the deck. By powerful motors controlled by men on the upper levels of the bridges or on "man-trelleys," the ore is scooped up from the hold of the vessel, swung over into a bridge car, and thence dumped directly into freight cars, standing on tracks below or into a large strongs space covered by the bridges. The system permits exceedingly rapid morement of the handling machinery. For example, the two eve-handling bridges of the Carnegie Steel Company at Youngstown, Ohio, have a span of 386 feet, travel at the rate of 150 feet jee minute, and can in a single twelvesjour day stock 181 cars with an average weight of 40 tons of ove.

A striking instance of great asvine in a manufacturing process by 7 a dead inprovement is the Gayley dry blast for
blast-turance operation, which was getinto service six years ago (August 17881904). In this process the six venitary
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By this simple change in blast-furnace operation, the result of definite engineering inventive work, marked sayings in raw materials are effected. The record of a typical furnace abowing an increase of output of about 39 per cent, with decrease in coke charged of about 12 per cent. But further than this, very valuable improvement is effected by reducing water of ore dust, ordinarily carried away by the blast; by reducing the power required in the blowing engines; in the ability to use cheap, high-phosphorus orea, and in the precision of operation of the furnace and the securing of iron of uniform great and composition.

The facts just cited runnaries the new order of thangs in the works of invention. Manufacturing takes the lead as the primary laterest, and inventing becomes one of its activities, but not less important by the change. The individual solitary worker, often insughed sit, as, it dreamer, though accessionally spaced, has given piace to the profrantises in the second situation of the control of th

Brueding Successful Strains of Banket Williams

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fast the seil selected is very often not strength of foreign competition, a rapid suitable. Many farmers are under the development in the quality of American militable. Many farmers are under the impression that willows should be planted in undrained sells, which is a serious mistake. Soil that vields a sond service metals. Boil that yields a good crop of wheat also produces a good crop of willows under proper cultivation. The successful basket-willow grower considers the selection of suitable soil as only one of the requisites for growing a prof-itable crop of rods. The proper selection and care of cuttings for planting will in sure an enormously increased yield, and in many cases actually double it, provided the willows are properly cultivated so as to keep weeds down and the soil loose Selected cuttings are of prime impor tance. The value of selection has long been recognized in the analogous case of seed in all our common agricultural

The willow is among the most plastic of all our woody plants, and is easily propagated by means of cuttings. The ancestry of a certain strain of basket willow is as vital as it is in the higher ani mais. Its characteristic qualities are quite readily transmitted from year to year and all varieties are susceptible to fur ther improvement. The investigators have even more control over the success ful propagation of selected varieties of than they do in cases of fruit trees or other farm crops, since a new crop of selected cuttings can be obtained every year from the preceding year's planting. Carefully conducted experi-ments in selecting and breeding certain varieties of basket willows will result in strains of entirely modified characterhave been developed out of the American which one is said to be entirely immune to the destructive willow rust. A num ber of strains have been developed from the common purple willow, all of which have their particular virtues in certain

The basket willow is a farm crop of increasing importance on both sides of the Atlantic, and the country that develops the most desirable strains is the one to control the supply of the market. At present European countries have a decided advantage over the United States. We cannot introduce strains de veloped in Europe and expect them at once to do as well here as they do in the locality where they originated. An Iowa grower introduced the common white wil-low (Salix vinimalis L.) from Europe, with the hope of producing as fine a crop of rods as this willow is wont to yield in its native country. With considerable expectation he waited for the remarkable crop he was going to produce, but the harvest showed him the danger of using cuttings not suited to his soil and climatic conditions. There are about ninety dif-ferent varieties and hybrids of basket willows that are successfully grown in Europe. In this country there are but kinds that are yielding good returns and only one of those is especially well suited to the lake States. Not a single variety has been found that can be grown successfully in the southern States

The desired improvement should be brought about by continually selecting certain rods from normal stools of a variclous treatment. To develop or to acc tuate a specific quality which the bulk of rods are now lacking is the most impor-tant consideration for the American willow culturists. Blender, cylindrical, fiexible, and tough rods are sought by the best basket makers, and so long as the American farmer is unable to raise a sufficient quantity of this sort, the man sufficient quantity of this sort, the manu-fracturers will buy their raw material in Europe. Consequently, the destactic rods will sell at a very low figure. Better strains of willows for local use will have to be developed, just an extent strains of farms crops have come to hap recognized. as builtable for local use. Because of the sangers carried as . . 780, faiture importance of the industry and the local as ten millon dollars.

grown rods is essential. This much-desired improvement of the basket willow in the United States can be brought about by continually selecting cuttings from the shoots having the desired qualities. Since such strains are not as a rule susceptible to general adoption, it will be necessary to develop different ones for different localities.

certain portions of Pennsylvania, Marviand, Ohio, and Kentucky, the American green willow is seriously affected with a willow rust which destroys the leaves prematurely, and consequently shoots die. This disease was first dis-covered in Maryland and Pennsylvania, and later it appeared in Ohio, and now is reported from Kentucky. A wide-awake farmer in the latter State observed that a certain strain of American green is very rarely affected by this rust. He concluded at once that this is an immune variety, which he is now successfully raising. This rust seriously affects the character and value of the rods. If the rods are not killed outright, they usually become so brittle near the top that the basket maker is unable to use

Farmers who wish to start a plantation

of basket willows should not buy a large number of cuttings by faith. There are nurseries springing up here and there, and the proprietors claim that they can furnish cuttings of all the best varieties known to willow culturists. The fact is that some of these nurserymen do not know the correct names of the willows they have for sale, nor do they know for what localities their varieties are best suited. Unless the farmer can buy select ed cuttings from his neighbor, he is likely to be at the mercy of the dealer living at a distance, since he may not see the stock until it arrives on his farm Al though basket-willow breeding cannot be followed in the scientific sense by the farmer, selecting cuttings from the sh on the stump and propagating them is a simple matter, and can be practised by any farmer Testing certain strains, continuing the best kinds, and discard the inferior ones are still less formida Basket-willow growing should be a matter of sentiment, and the farmer should have a desire to see them grow under the best of care and cultivation. Unless the farmer does grow the best strains and put his heart into the work, he is not worthy of the meager results he'does obtain.

Studies of the Aurora

(Concluded from page 10.)

eter and 2 inches focal length. He made 800 photographs, about half of which were successful. The aurora was photographed simultaneously from two stations, nearly three miles apart, which were connected by telephone. This made it possible to determine the heights of the bands and streamers, which were found to range from 30 to 125 miles. As the atnosphere at these elevations is composed almost entirely of nitrogen, it is not surprising that the bright lines of the auroral spectrum are nitrogen lines. In view of the satisfactory results which Stoermer has obtained with exposures of a fraction of a second, it seems not unlikely that the aurora will soon be captured by the kinematograph. At all events a system-atic application of Stoermer's method will secure data of great importance for the study of the surors and will explain many points which are now uncertain.

The New Cunarder.—The latest reliable information from England gives the length of the new Cunarder as \$85 feet on deck; the beam as \$5 feet 6 inches; the total displacement as \$6,000 toms; the speed as \$7 kinds, the number of passages. ngers carried as . 790, and the total



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Reil Inches .-The extent to which all insurance is carried abroad is indieated by the report made at a recent meeting of the Nurseryn Market Gardens and General Hallstorm Insurance Corporation, in England, that the area of glass insured in that country now amounts to 37,700,000 square feet.

An Island Swallowed by the Sea. -The island of Iliopango Lagoon, Salvador, disappeared on December 17th after a series of earthquake shocks and slid into the depths of the lagoon, carrying with it nearly all of the inhabitants. At least seventy families, numbering all told about 170 men, women, and children. were engulied.

A Bargain in Radium.—The director of the English Radium Institute, Mr. Alton, recently went to Vienna to purchase a gramme of radium from the Austrian government. Mr. Alton rep-resented Sir Ernest Cassel, who is willing to defray the expense. The price will be about \$70,000 for a gramme, which is considered cheap.

What Money Can Do for Science— Prof Karle Schwarlschild, in a recent number of the International Wockes-schrift, comments on the triumphs of American astronomers. After paying a tribute to the thorough work of American astronomers, he points out how wonderfully they have been helped by their excellent equipment and endowment. He finds that five of the greatest American observatories have among them \$250,000 annually at their disposal, while the ten leading German observatories together have only \$87,500

Studies of Carbon.—The investigations of British scientists have brought out some curious observations about carbon and the astonishing relation of its properties to the geometrical figure known as the tetrahedron, a solid bounded by four equilateral triangles. It is said that the completeness with which the funda-mental properties of the carbon atom are symbolized by a regular tetrahedron is altogether astounding. That atom, it annears, has four affinities, which operate practically in the direction of the four radii, proceeding from the center toward the four solid angles of a tetrahedron. In the future, it has been remarked, when the archeologist of the time shall dig for signs of our life, he will find the tetrahedron and the benzene hexagon among the mystic symbols that he will have difficulty in interpreting. If, like the ancient Egyptians, we made our tombs records of our wisdom, such symbols would long since have acquired sacred significance.

Work at Mt. Weather.—The report of the Chief of the Weather Bureau for 1910, just published, gives prominence to the aerological investigations carried out at Mt Weather Observatory. During twelve months there were only nine days on which kite or balloon ascents were not made, owing to adverse conditions of one kind or another Free sounding balloons cannot be used at Mt. Weather, owing to the proximity of the ocean to the l ward, but the observatory staff has made successful use of these instruments at Fort Omaha, Neb., and Indian-apolis, and on one occasion reached an altitude of fifteen miles. Among the interesting results already attained is the fact that the stratification of the lower portion of the atmosphere, as regards its temperature and moisture, is more ex-tensive than was hitherto suspected. There are many exceptions to the rule of decrease of temperature with altitude; thus a great layer of warm air is sometimes found floating upon a layer of cold air. It may be remarked, in this connection, that the stratification of the atmosphere has also been noted and dis-ROM MINES

B. MARTIM.

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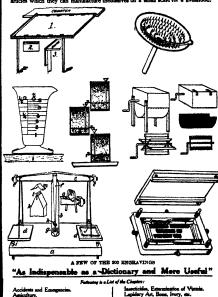
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Electricity

Wireless in Court.—During the hearing of the case of Marconi va. the British Radio Telegraph and Telephone Com-pany, in the King's Bench Division, London, the judge and lawyers will have practical demonstrations, permission having been granted for the conversion of the court into a "wireless" operator's the court into a "wireless" operator's office. Messages will be sent and received. The arrangements will be carried out un-der the superintendence of Prof. Boys.

New Power Plant for the Boston Ele-Company is about to build a large power plant at South Boston. Two turbo-alter-nators of 15,000 kilowatts each will be installed, but provision will be made for ase should the next Legis lature permit the suburban trolley sys terms to come under the control of the company A large coal plant, with a capacity of a hundred thousand tons, will

electrifying the main and suburban lines within fifteen miles of Boston has been estimated at \$82,751,942, of which six million represents the cost of the generat-ing system of 60,000-kilowatt capacity, and nearly four million the cost of the transmission lines and overhead system. The outlay for electric locomotives is placed at a little under seven million, and it is estimated that the multiple-unit motor cars will cost a trifle more. multiple-unit trail cars will cost about five million This covers the electrifica-tion of the New Haven and the Boston and Maine lines, with 461 miles of track, and a daily service of 14,630 train miles.

Water Storage versus Storage Battery. suggests that it would be more econom ical to use water storage in power plants in place of storage batteries, the idea being to provide motors for pumping when the load is light, and to us these motors as generators driven by Pelton wheels during the peak load. To illustrate the advantage of such a system, he assumes the case of a 10,000-kilo watt plant with a spare plant of 2,500 kilowatta in the form of lead storage batteries, steam generators, for his proposed water storage By providing a haft of a thousand feet with a reser of 14,160 cubic yards at the bottom of the shaft, he concludes that the capital cost of the water system would be \$130,000, and annual charges \$11,100, as against \$160,000 capital and \$20,975 annual cost for storage batteries, and \$187,500 capital and \$21,500 annual charges for steam.

Wireless Storm Warnings.—On November 1st the Deutsche Seewarte, at Hamburg, inaugurated a system of storm warnings and daily weather bulletins by wireless telegraphy, covering the North See and the Baltic. Whenever a storm warning is issued that applies to the North Sea it is telegraphed three times from the wireless station at Norddeich, while similar messages referring to the Baltic are sent out from the station at Bülk. The same warnings are repeated either at 1 P. M. or 11 P. M. and are then sent slowly; this is for the benefit of small craft which are not able to maintain a constant wireless service and whose inexperienced operators would have difficulty in receiving a message sent at ordinary speed. A weather re-port, describing the state of wind and barometer over Europe as shown by the morning weather map, is sent out with the daily time-signal telegraphed from Norddeich at 1 P M. The number of small German fishing vessels equipped with wireless apparatus is rapidly increasing, and it is proposed that the imperial government shall contribute to the expense of installing such apparatus on many vessels not yet equipped. condition that the vessels thus favored shall undertake to by means of ordi

Engineering

Commerce Destroyers "Minneapolis" and "Columbia."—It is proposed by Chief Constructor Watt to transform the swift and once famous commerce destroyers
"Columbia" and "Minneapolis" into
"mother ships for submarine boats" He proposes to remove about two-thirds of the boiler power, and two of the three engines in each ship, thus making then economical in operation.

Grand Prize for Brennan.—The au-thorities of the Japan-British Exhibition in London have awarded to Louis Bren nan for his gyroscopic monorali tion the Grand Prize, which is the highest award given in connection with this exhibition The Brennan gyroscopic car was the first car of practical dimer sions to maintain its equilibrium while running upon a single rail.

High-Speed Steam Yacht. - America is the home of the high-speed steam yacht Among notable vessels are the 25-mile
"Niagara IV," and "Vixen II," the 27mile "Vitesse I.," the 32-mile "Little Sovereign," and the 33-mile "Vitesse." is now being built from the design of Mr is now being unit from the design of on Charles L Seabury a steam yacht "Sover-eign," 165 feet over all, driven by twin screws, for which the builder has guaranteed a speed of 35 miles an hour.

The Most Dangerous Occupation.—According to the Insurance Age, the work of railroad trainmen is not the most dangerous occupation. It seems that the highest percentage of fatality is found among the fishermen of Gloucester, Mass achusetts, where it is nearly twelve per cent of the total number employed. For the decade ending in 1907, the mortality percentage among railway men was about 8 per cent. The number of deaths due to accidents of occupation among all wage earners annually is between thirty and thirty-five thousand, the non-fatal accidents exceed two millions

World's Iron Supply. -In the course of a recent address on geology and economics, Prof. Kemp, of Columbia Univerof Carnegie and others as to the early failure of the worlds from supply failure of the world from supply failure of the world failure of t known to exist in Cuba, Newfoundland, Brazil and elsewhere, and the probability of discoveries of other deposits elsewhere, he estimates that the world's supplies when fully opened up will prove sufficient to last for fifteen hundred years

The Canal Should Be Fortified. -- Referring to the necessity for fortifying the Panama Canal, The Army and Navy Journal suggests a situation, in which a war has broken out on the Pacific and our ships, concentrated in that ocean, have met with a disastrous defeat. The ap-proaches to the canal being in the hands of the enemy, the Gulf and Atlantic coasts would be in a state of panic lest coasts would be in a state or panic lest his fleet, passing through the canal, in a few hours would be off a great southern or eastern port. Were the canal impreg-nably fortified, forty days would intervene before the enemy could reach New York by way of the Strait of Magellan.

Terminal Docks at Staten Island.-The ambitious scheme to provide a vast ter-minal at Staten Island for the New York State barge canal has recently been brought into prominence by the visit of an influential committee to view the site. The location selected on the south shore of the island is admirably adapted for the purpose, the bottom being suitable for the foundations of the piers, which are to be 1,500 feet in length, and the main channel lying adjacent to the proposed pierhead line. The time is coming when sites for further extensions of docking facilities will have to be sought away from Manhattan Island, and receive all storm warnings, and dissemings is it in question seems to be one of the finate them among the shipping generally by means of ordinary optical signals.

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AN ADDRESS TO OUR READERS

THE MAN who christesied The Scientific American little realised how scientific the American of the future would be. As it happens, "science" has become the watchword of the Twentieth Century.

Americans are peculiarly a scientific people. Their advance has been along the line of invention applied to great resources of nature. The Scientific American, founded sixty-five years ago, keeping step with the scientific development of this country, has become to-day the official organ of those people who really do things, and who want to know what others are doing.

Just as older countries have added to the world's art, literature and music, this country has added to its science, invention and industrial progress. The publication that has most carefully recorded these great discoveries is the most necessary publication to the average intelligent, progressive American.

No adventure of the past is so great as the adventure which ultimately will lead to the conquest of the air, to driving enormous tunnels under great rivers, to sending telegram without wires to all those great phases of invention and discovery which have raised the strength of man s puny arm to the nth power.

Ten years ago a tunnel under the Hudson River was a visionary dream. To-day you can be whirled underneath this river in rapid, well-lighted, clean trains through any one of several tubes. In a very short time the two great continents of America will be sawed in two. This enterprise, please bear in mind, attempted by another nation, is being accomplished by ours.

It is because such things are natural to the temperament of the average American that his logical magazine is The Scientific American. What it has done well in the past it will do better in the future.

The history of the rise of the automobile is already found in its pages from the first tentative experiments down to the wonderfully sure and beautifully designed machines of to-day. What has happened in the automobile industry is now happening in the field of flying, and when this is finally accomplished its history will be written in The Scientific American by the men who knew—not an outside reporter's account, but an inside scientific man's account.

You want to attend an aviation meeting with a definite understanding of the difference between a Wright hiplane and

a Blériot monopless. Very part of year to The regular reader of the Semential American is in stope touch, not work to with the theory of Bring, but with its different applications. He is just as far along as the men who are decay it. He understands the problems, and he looks upon each successive advises with the intelligent comprehension of the stage manager behind the seage not with the injectified wonder of the same in the parquist seat.

This, then, is the ambitious progress of The Scientific American; to be what it has always been, but widesed and broadened and despined because its field is widening and broadening and despening.

Baginning with the current number each issue of The Scientific American will have four additional pages, except that once a month in the so-called monthly issue it will have many store pages than the regular issue and will be enclosed in a colored cover. This is to afford more room to cover the subjects which have become necessary because the field in which The Scientific American strade done has been growing so rapidly. It will be a paper made better by circumsustance.

Sixty-five years see The Scientific American picked out its own particular field in journalism. It was alone in that field them and it is alone in that field to-day, while that field is nevertheless one of the most important, if not the most important, if not the most important, to every citizen of this country.

Its editors are trained mon-trained in their respective lines. These men are in touch with all the men working in different fields of work who are best fitted to express in simple but exact words the progress of each department of human endeavor. The Scientific American will be the authority; it will be the first news as well as the most complete news of any new development.

We do not know what the next ten years will bring footh. We do not even table what the next ten months will bring footh. We do not their what dering conception approaching actual application may be in progress next year as aviation is in progress that year. We do not know what will take the place of the auto-mobile ten years from now, but we do not know that what we have the The Scientific American will present it to the medien by picture and text so, graphically the every-reader will feel that the was position at its inception, witnessed its progress and triumphed in the application.

THE PURISHER.

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Automobile Prices Revolutionizing Motor Car Standards

FIE United States Motor Company announces a prev schedule of prices, effective now This semiconsorment has appeared in the newspapers of ferry-nine cities. The automobile world—the entire reaching public—will be amazed that this announce-ment, involving as it does lower prices for 1911 models, is made during the New York Show, which is the signal for heavy buying to begin We therefore earnestly request you to read every word

on this page. It marks the beginning of a new epoch in motor car history—the establishment of new automobile standards-the attainment of which was only possible through the co-operation and organization realized in the formation of this company

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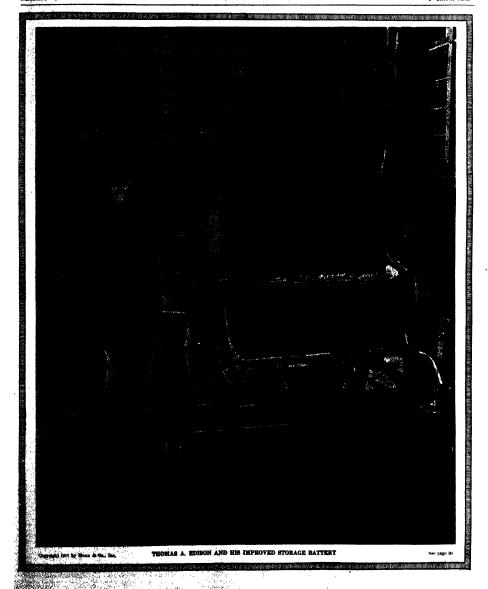
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The purpose of this journal is to record, accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination

The Death Roll of the Aeroplane

THE shocking list of fatalities to airmen, ending with the tragic death, of Hozsey and Mousant at the very close of the year, has sent a thrill of horror throughout the civilized world. Doubtless it will lead many people to ask whether the risks of the new and fascinating art are not so great as to raise doubts both as to its utility and permanence. For ourselves, we believe that nothing has occurred that warrants our losing faith, either in the usefulness of the new art, losing faith, either in the usefulness of the new art, or in its permanent hold upon public sympathy and interest. The thirty or more deaths which have occurred, considered by themselves, represent a terribic toil taken by the laws of Nature on those who have so bolilly ventured into the hitterio inaccessible occan of the air. Yet, we must not forget that if the increase in the number of secielents has that it the increase it the number of accidents has been great, it is not out of proportion to the great increase which has taken place in the ranks of the practical aviators. Indeed, an estimate that has been made in one of the French papers devoted to aviation shows that the ratio of accidents to the number of people engaged in flying, was considerably less this year than it was in the year preceding.

ably leas this year than it was in-the year preceding. As regards the future, we believe that the proportion of accidents will unstrailly decrease, and this for several reasons. In the first place, the builders and users of aeroplanes make every effort to ascertain the details of all serious accidents that occur and determine their causes, whether they ay in the faulty construction of the machine, or in the lack of skill or the over-daring of its manipulator. It is probable that every accident yields its quota of valuable lessons for guidance in future construction and future handling.

quota of valuable lessons for guidance in future construction and future handling. The same French authority, after making a care-ful investigation of the accidents of last year, has concluded that only a small percentage was due to concluded that only a small percentage was due to defects in the machines—an opinion in which we are included to concur. At the same time, there is no doubt whatever that with a few exceptions, the, majority of aeroplanes are built with too slight as margin of safely of strength in their various parts. We pointed out recently, in our article on "The Raeing Aeroplane of the Future," that by the use of hadring Aeropiano of the runter, that by the use of the higherance steel alloys, of high elastic strength, and great toughness, it would be possible, without any mercase of weights, to build a flying machine that would be strong enough to resist, not merely the ordinary stresses which occur in straightaway flying, but the abnormal stresses to which the machine is subjected in stormy weather, and when the aviator is making those spectacular dives and other attractive maneuvers which have become so popular with the ee-going public.
With a few exceptions, the machines which are

With a few exceptions, the machines which are in use at the present time cannot be said to have been designed by men who possess the theoretical knowledge which is necessary in the planning and construction of these delicate and unusual mechanism. The new art, however, has now reached a Fastage of popularity at which it has become commercially attractive. Capital is not only available, but is positively eager to lend itself to the exploitation of the flying machine; and skilled engiacers are being attracted in increasing numbers to the

new industry, which is at a stage where it can, afford to employ the best engineering talent.

A disconcerting feature of last years dealt will be a dealth will be a dealth of the control of the last ward of the most attack. The features the stage gest that we have not advanced as far is war supposed in our understanding of the conditions that govern the flight of heavier-than-sir machines, on the other hand, at should be remembered that many if not most of the accidents have occurred when the airmen were attempting spectacular performances for the entertainment of the reaccigning public or to win large money prises. There can be

when the airmen were attempting spectacollar per-formances for the entertainment of the race-going public or to win large money prizes. There can be no doubt that this spirit of daring has been carried allogether too far; and it is to be hoped that the leason of caution which has been taught with such tragic significance will not be lost. Although the conseonas of opinion among avis-tors seems, at the present writing, to be against the such a such as the present writing, to be against the use of automatic entrely, we still believe that the perfected machine of the future will embody this feature, and that it will be of speh a flexible char-acter as to leave the operator with manual control of his machine at all times, and yet be capable of preventing such complete loss of equilibrium, as preventing such complete loss of equilibrium. Such flossey, and Mojagut. We are inclined to think that the combined, use of the dishorts, angle into the acroplane of the future with a self-righting ability similar to that shown by the birds of the air, when they are accidentally capsized.

Producer Gas Engines for Marine Use

COMPARATIVELY new departure in marine engineering is the equipment of vessels with producer gas engines. As yet the number of such installations can be counted on the fingers of one's hands; but the indi-cations are that this system is destined shortly to cations, are that this system is destined anormy or find very extended use. It is therefore with particular interest that we note a paper recently always the property of Naval Architects and Marine Enganeers by C. B. Page, or "Marine Installations of Producer Gas." Much Sustable information as contained in this paper. Marine Enganeers by C. B. Page, on "Marine Installations of Producer Gas." More valuable information is contained in this paper. Some of the advantages of the system are clearly brought out by figures cited with reference to the "Mary A. Sharp," a boat plying on Chesapeake Bay, and equipped with a producer gas engine. The fuel consumption is remarkably low, 1.13 pounds per indicated horse-power. The average indicated horse-power during an actual-trip was 60.8, yet the engine with its producer is contained in a room measuring but 13 feet 3 inches in length. The weight of the engine is 8.600 pounds, that of the producer 6,000 pounds, thus giving a total weight per indicated brake horse-power of 200 pounds, the producer that the producer has cylindrical steel shell lined with asbestos and fire-brick. In operation, it is quite warm to the touch, but not excessively hot. The gas is drawn from the producer by the system, of the engine, so that the former is always at reduced pressure, and there is no possibility of

of the engine, so that the former is always at re-duced pressure, and there is no possibility of leakage of the poisonous gas into the engine-room. In land practice it is enstemary to introduce water into the producer, for the double purpose, of erriching the gas (by the formation of waterggas), and of softening the clinker. Attempts to use this same expedient with marine producers have proved futile, owing to the deposition of salt and the effect of the motion of the vessel summ the water yearsand to stotening the connect. Accompts to the cris some expedient with marine producers have proved furthe, owing to the deposition of salt and the effect of the medical content of the medical content of the medical content of the medical content of the content

The New York Aviation Sh

HAT the New York Arieston filter us. have lacked in size it gained in the merel carelloner of the children and the fact that the whole display, with the acception of the exhibits of a Bleriof end a Demostralia caption of the cricibits of a Bieroti side I Pennishelic machine, was distributed a Bieroti side I Pennishelic machine, was distributed Americais. Furthermore, it is an encouraging fact that at this comparatively early stage, an exhibition of this character about the so singularly termed the "freat" type. In all side so computerly termed the "freat" type. In all side so computer with the complex with the complex with extended the complex big discussed with the complex with the complex of the construction which was a matter of frequent comment in carlier Wright belience.

planes. The other machine was a "Baby" Wright, with unstaining surfaces 80½ fact by \$1½ feet and total area of 185 square feet, driven by a 28-horse-power engine at a speed of nearly 40 miles as hour-This, 6yer has done some particularly good altitude work, having attained at Belmont-Park an elevation of 9,715 feet. It has a clambing speed of 500 feet nor maints.

This, diver has done some partiensary, good artitude work, having attained at Belmont Park, an elevation of 9,716 feet. It has a climbing speed of 900 feet per mingth.

A stand which sitracied considerable interest-was that of the Flyers Chub, which exhibited an interesting group of models, made chiefly by the younger members among the acronustical cuttinuisate. In the next stand was a biplane of the Curties type built by C. and A. Wittenam of Stabin Island, in which were several new and excellent features. The sustaining surfaces, 88 by 5 feet with a lifting area of \$80 square feet, were set at the slight directal angle of 5 degrees: Spruce has been adopted in place of hamboo, as being lighter, and the total weight of the machine has been kept down to 500 pounds. The front and rear control are connected. Best the heriscontal and vertical rudders are operated by a recking shaft. The chassis is mounted upon three wheels, all of which have spiral spring vertical shock absorbers, while the two mainwheels bounds the heady of the machine have spring-controlled lateral play.

The Walden-Dyott monoplane, shown in the adjoining stand, has the distinction of heing the first American memphane to make a seconstal flight. He wing surface, \$845, feet by 7 feet, has a total area of 183 square feet. The machine is driven by a 54 H. F. 3-cylinder Annani motor of the model used by Rieseis to his consectance of the model used by Rieseis to his consectance of the scale of the surface of a small plane surface set at an angle laterally of about 86 degrees to the wings, the theory being that the stabilizer on the depressed and presents an increasing reaction, while that on the provision at the tip of cach wing of a stabilizer, consisting of a small plane surface, set of an angel laterally of about 86 degrees to the wings, the theory being that the stabilizer on the depressed and presents an increasing reaction, while that on the provision at the tip of cach wing of a stabilizer, consisting which as a complete a star of the provision

Company of the Type, with the company of the Compan

Glenn Curtiss Wins the Scientific American Trophy

The First Aeronautical Trophy to be Offered for Competition in America

winning for the third time the Scientific Landing of the year, Giann Curties becomes the permanage of the year.

ment, owner of a price whose value will appreciate an the years pass on. Inasmuch as this year the first price of any kind offered in justice, the connection with the new art of string, the brough must always stand in a classe thy feest, and we congratulate kir. Curtise on the fact that, among the price which, he kins taken, is included one of such unique distinction as this.

such "makes distinction as this.

In the 'zer 1807, when the publishers of
the Remayer's dustrictor amounted the
offer of this tropky, the art of giring was
yet in its infancy; and this in spite of the
face; ikist che Wright brothers, some years
selves, had made their wonderful demonstrated an their home town of Dayton, Ohlo.
Outside of those performances, practically
nothing had been accomplished in the country where mechanical flight had had its
bitch. The French people, with their usual
airctures and enhanciam, had been quick
to appreciate the significance of what the
Wrights had down, and were busing engaded, in
the attention better them; but America,
strange to relate, was exhibiting an astonising lake of appreciation of the openmaking achievements of their fellow countransa.

It was to the hope of awakening an interest in the fring mechine and stimulating our inventors and manufacturers to take held of the lew art and assist in its successful, development, that the Schreyrick American dedded to offer for competition the silver trophy, an illustration of which is given herewith. The deed of gift by which it was transferred to the keeping of the dero Club of America, called for annual competition by heavier-than-air machines, with the undestrainding that the conditions governing the contest were to be changed from time to time, so that they would keep pace with the progress made in the art of flying. The constituent laid down for the first year seem to us remarkably easy in this day of gross accomplishment. The competitors were required to make a straightawn right of one kinemeter (6.831 mile) in a straight with the competitions with the trophy for that year by flying for a distance of slightly more than a mile in his new biplane, the "lune Blug." During the following year, such remarkable progress we being made with remarkable progress we being made such cases and the such remarkable progress we being made such remarkable progress we have made such remarkable progress we have heling made such remarkable progress we have being made such remarkable progress we have heling made such remarkable progress we have heling made such remarkable progress we have made such remarkable progress we have made such remarkable progress we have heling made such remarkable such r

by the French aviators, that the conditions of competition for the year 1999 were made more severe, and the competitors were required to cover 25 kilometers (15½, miles) in a closed circuit, that is to say, the course was 5 kilometers (2.1 miles) longer

than that required in the international content for the Gordon-Bennett rouby. This was the intilnavam distance that the competitor must cover to write the trophy, which was to be awarded to the aviator who made the fastest and best fight in a closed circuit during that year. Circline was the only compellent to entire the counter, and he established his claim upon the out for a second time by frigg over a closed, circuit out little labout for double the distance required in the Semmet only race. The third and has introduced in the competition of the second time by frigg over a closed, circuit out little labout for double the distance required in the Semmet only race. The third and has introduced the competition of the competit

out any competition. In 1908 and to a less degree in 1909, this indifference was excusable for the reason that outside of Curtles and the Wright brothers, there

SCIENTIFIC AMERICAN TROPHY Won in 1908, 1909, and 1910 by Glenn H. Curtiss.

were no aviators who were sufficiently skilled to compete with any prospect of success. During the past year, however, progress in flying in America has been rapid, and there were several aviators possessed of good machines, who could have entered for the cup



GLENN H. CHETGE, THE WINNER OF THE SCIENTIFIC ARCHIGAN MERONAUTICAL TROPHY. Poot by Lovice.

with more than an even chance of surpassing Mr. Curtiss's flight of 74½ miles. The fact that no entries were made proves that there has been a decadence

of the true sporting apirti, competitors preferring to enter contests in connection with which large each prizes were offered Outside of the intrinsic value of the Silverire Assances Trophy, which is not inconderable, there was no inducement to fucur the resolute and expense of trying for a crosscountry record, other than that of the distinction which was conferred on the successful competitor, and the fact that the whathing of the first trophy of any kind offered in this country should have so signally failed to appeal to Anerena systems, certainly indicates a lack of the true sporting instinct, and proves that the game is governed by the professional, as distinct from the true nameder spirit.

from the true amateur spirit.

In view of these facts, we feel that no little credit attaches to Mr. Curtus, who has always evinced the greatest interest in the competition, and who, it successful competitors had come forward, would undoubtedly have put up a strong fight to retain the troubly

Prischneer, working in Mine Curve's radiological institute, has discovered that the rays emitted by strong radium preparations have the power to induce crystallizations have the power to induce crystallization in supersaturated solutions and in liquids cooled below the normal temperature of solidification. In both of these classes of "metastable" liquids, the incidence of radium rays is equivalent in effect to the addition of a minute crystal of the dissolved or fused substance.

The occurrence of something resembling disease in metals was discovered a fow years ago. Tinware is often found spotted with an amorphous gray powder. This condition has appropriately been called the tinware, placed in contact with this powder at a favorable temperature, becomes infected, and the tim plating slowly crumbles to dust. The spontaneous occurrence of the p-st has been observed only in very old tinware, but Frischneuer has discoved that the disease is quickly produced in new tin vessels by the rays emulted by radium

All of these phenomena can be explained by the assumption that the substances are in a state of unstable equilibrium, like a wagon on the brink of a precipice it needs but a slight push to send the wagon to the

bottom, and only a small impulse is required to crystallize the metastable liquids, or to convert the tin into the amorphous condition, into which it has a tendency to pass. According to a theory propunded by Mmc Curle and Prof Lippmann, this impulse is

given by the impact of the electric particles projected by radium. The plausibility of this hypothesis is increased by Frischauer's discovery that no similar effect is produced by Montgen rays, which do not contain electric particles.

The Metropolitan Railway is trying experimentally a new type of car. The corridor principle is adopted in the new coaches, which have three specious compartments, with a door to each and a contral gangway running the whole length On either side of the gangway in each section seats are provided for four passengers, two a side, while the seat at either end of the impartment can accommodate six people the emergencies of the traffic require, making twenty-eight seats altogether in the making twenty-eight seats altogether in the coach Two trains are to be used for the experiment. They will be run between Liverpool Street and Chesham and Ayles-To Harrow electric traction will be used; beyond Harrow steam engines will be employed. Some compartment stock is alrun by the Metropolitan in its through trains between the City and the Aylesbury and Chesham lines, and a strong proferonce is shown for it by many regular travelers, who make up parties. If the results of the experiment are satisfactory, more of these trains will be built.

Thomas A. Edison's Latest Invention

A Storage Battery Designed and Constructed from the Automobile User's Point of View

By Joseph B. Baker, E.E.

For over a decade, Thomas A. Edison has been working to produce a type of stomes buffery better than the old lead type. At lest he has succeeded. His new cells are now in adulal som article the reader will find a description of the new bettery, written after a parataking study of its manufacture.



LD, indeed, is the idea of the commercial storage bat-tery Lead plates were immersed in an acid electrolyte, by Gaston Planté in 1861. Emile Faure brought out the pasted-plate battery in 1879, and Charles F. Brush in 1881 introduced

improvements which made the lead battery a factor in electric vehicle work, producing a cell which would give eight watts of

electric power per pound of material From these early beginnings, many inventors have sought to increase the electrical efficiency, and the durability or "life" of the cell and reduce the cost of manufacture.

It was in the eightles that the public be gan to think about "stored gan to think about "stored electricity" which could be bought by the can, as it were, like any other com-modity. This dream has modity This dream and come true in the new cell. Stored electricity finds its greatest usefulness in propelling cars and road vehicles, and it has been for this application, primarily, that the Edison storage battery has been developed. The need of the

electric vehicle was recognized by Mr. Edison nine years ago. He saw that there are two view-points. that of the electrical man with his instruments, his rules for efficient operation and reasonable life of the battery, his absolute knowledge that th same care should be given a vehicle battery that is given a valued horse or even a railroad loromotive; and that of the automobile driver, who simply wishes to go somewhere with his car, and who, when he arrives somewhere, wishes to go back. And in this long-promised battery the highly practical nature of Mr Edison's k is once more exemplified in that he has held uncompromisingly to the automobilist's point of view. The fact to be

faced, he realized, is that the electric vehicle user laced, he resilied, is that the electric venture user will work his car to the utmost, and will be limited only by repairs and breakdowns; just as the average gasoline car driver has always operated his car to the limit of repairs and breakdowns. How well he has succeeded in aligning his battery to this ideal, the automobile driver will appreciate from the figures of actual performance that are now available. A recent average of 144.35 miles on a single charge was cent average or 144.30 mites on a single charge was made in a family-type electric vehicle equipped with the new battery. This figure is the average of four trips, each with New York city (Manhattan) as the starring point. The longest of these trips, 172.1 miles, was to-Habyion, Long Island, by way of Miscola and Plainview, returning by the southerly route through Massapequa and Freeport. The map distance by this route is 90.9 miles, and 91.3 miles additional was covered after the regular run, the average speed being 10.93 miles per hour.

THE REPORT OF SHIPPING AND SHIPPING SHI

The original Edison storage battery, known as the type E, was put out about seven years ago. The type E cell marked a definite step in invention, in that it proved the commercial success of a wholly new that it proved the commercial success of a wholly new voitaic combination, a radical departure from the lead plates in an acid electrolyte. Believing that the lead cell had too many inherent weaknesses to reside the full promise of "stored electricity" as a motive power for veholicit, Mr. Edi-son had set his staff to work on an entirely new line, and the outcome was a nickelvion et em en t i m-

nickel-iron element immersed in an aikaline electrolyte, lighter and cleaner than the lead cell, with lower cost of operation and pkeep to offeet its higher initial cost, and possessing hitherto unheard-of preperties of remaining undeteri-orated either by over-charging or being left uncharged These were the very qualities demanded by the automobile user. The cell developed certain weaknesses in service, which caused the inventor to withdraw it from the

ments to improve the form of

in each sixe

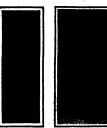
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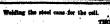


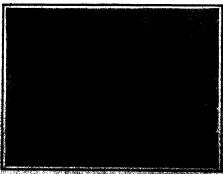
"resitive plate as the right with zeicech hydrate active material in perfected tubes. Negative plate at the laft with iron catele active makerial in perfected fix with iron catele active makerial in portrosted fix pockets.











THOMAS A RODOWN LATROT SHYRIPSON

The Modern Pleasure Electric Vehicle

Some Interesting Problems of Design and Construction and Their Solution

By William W. Hudson

The electric pleasure cet is coming into its own. For certain londs of service it is idead, its aimple and presponsive control will always be its most remembable feature. The goodine cut has perhaps of excursed the development which the electric has been undestoring in recent years. Here will be found a summery of those mechanical and activate perfections which have been undestoned in recent cars, and which have elevated the presentations. Propriet misconceptopions are corrected, on for as the function and energy of the admissible through the elevated reveals also increased. Internation is the electric customs in Blandrade. The memoral which the designer is handlappeed in planning and installing a motor, the difficulty of obtaining a satisfied drive, the many mechanical expedients devised to make the electric customs are strongly and the electric customs are strongly as a strongly and the electric customs are strongly as a strongly and the electric customs are strongly as a strongly and the electric customs are strongly as a strongly and the electric customs are strongly as a strongly and the electric customs are strongly as a strongly as

I F the problems of the electric automobile engineer might be summed up in a single word, that word would be beloance. How to secure and how to maintain the nicest degree of balance between the elements he has to deal with, the limited power at his command, the unusual weights of his mechanism, the variable loads to be provided for, and the widely different requirements of future possible owners.

The apopular misconception of a storage battery as a machine that stores the electric current with which it has been charged needs to be cleared up before the problem can be fully grasped. The storage battery is a chemical retort containing certain elements—lead, perceide of lead, and sulphuric acid in the case of the lead pasted battery; iron, nickel, and an alkaline solution in the case of the Edison battery. The passage of an electric current through the cells (the process of charging) decomposes these jeaments, and the strong chemical safinity between the elements sets them at once to combining again. While this goes on

electricity is given off (the process of discharging). The current thus given off during the chemical combination of certain elements is the whole power at the engineer's disposal. His problem then is above everything a problem in the economical use of

It is true that the energy in the battery may be increased by adding to the number of cells, and the mileage per charge extended by the use of thinner plates; but with the heavy or high mileage battery the ratio of torque to weight is very low, while with a battery of medium size the ratio is relatively higher, so that for the purpose of a piessure carriage as economical limit is quickly reached, byond which it is not wise or practical to increase the size of the battery. Electric carriages are in use with lead batteries ranging from 34 to 44 cells in size, but the number of cells is in general proportioned to the size of the carriage and the service required by the

The most used and least expensive type of battery is the level quasted battery, invented thirty years ago, but still in course of improvement and development. The composition of the plates has received constant study from chemical and electrical experts, and the materiels now used differ in many respects from those of former years. This study of the conditions of battery service or electric wheltes has developed a plate of much greater efficiency than that of the older type. The use of wood separators has considerably reduced the weight of the batteries and added to their capacity plates has prevailed within certain limits are most efficient rate of discharge has been determined to a nicety and approximated in all recent construction. Finally, the elevation of the lattery to admit of a greater accumulation of sediment below the plates has added largely to its life, capacity, and efficiency, and has materially reduced the cost of up-keep, both in leasening the necessity for frequent



Interior of an electric brougham. A remarkable combination of appointury and control devices.



A typical controller for electric vehicle



A knife-blade controller, one of the more highly developed forms.



Steering-rod, switchboard, controller lever, and reverse lever of an electric carriage.



A second while there a prival promposed of motors



Cytinder type of controller, showing location of





Rear axie, showing double chain drive, location of power plant, and one-half of battery cells,

The state of the s

washing and in extending the time before a renewal will be required.

In recent months the Edison nickel steel battery has come into practical use and has had its influence upon the design and construction of the latest models —an influence destined no doubt to increase with Of greater bulk and smaller weight than the lead battery, it has developed quite phenomenal mile age, and is believed to have considerably longer life than other batteries

THE TYPE OF MOTOR

The designer of an electric is limited again when it comes to the type of his motor. Economy of bat-tery energy must be the first consideration, in order ease the radius of travel and lengthen the thus to incrlife of the battery. It is a well-known fact that the life or any battery is in direct proportion to the number of discharges to which it will be subjected under fixed conditions. The essential factor in a motor built for an electric vehicle is great overlag capacity. With a series-wound motor it is to be expected that the speed and efficiency will be at maximum with minimum, load. The special problem in designing a motor is to preserve this efficiency as nearly as possible from minimum to maximum load. The four-pole series-would Westinghouse motor is employed by some manufacturers: the compound wound nultipolar Hertner type of motor by others. While multipolar rectuer type of motor by others. While there is a difference of opinion as to their relative merits, it is generally admitted that the compound motor draws a heavier discharge from the battery on grades, thus lessening the available mileage and in creasing battery wear

Having determined the type of his battery and motor, the designer will next consider the form of driving system that will present the highest ratio of torque to friction The same problem has been met and wrestled with by designers of gasoline cars since the industry began, but with a difference Econ omy of friction, which is a matter of some importance to the designer of a gasoline machine, is a question of the first importance to the designer of an electric automobile Such matters as proper methods of weight suspension, proper distribution of weights, suitable suspension, proper distribution of weights, suitable gears and bearings, are of vastly greater significance when the available power is the electrical energy given out by the combination of chemical elements in a storage battery than they are when a gasoline explosion engine is producing the driving force Among electrics, as among gas cars, there is a great variety of drives to choose from

SPLECTING THE DRIVE

Several manufacturers still maintain their preference for roller chains, pointing out that this form of transmission is commonly used in racing cars of the gasoline type, owing to its high relative efficiency objections most commonly raised to chain drives are their noisy running, their rapid wear, their expos ure to dirt and dust, and consequent loss of efficiency To avoid these troubles the tendency of after wear the most advanced motor-ar construction has been toward the adoption of some form of shaft drive Among the limitations of the electric designer is to be noted the fact that some forms of shaft drives that have been successfully adopted by gasoline builders have not met the requirements of electric service

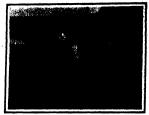
Several successful forms of shaft drives are how. ever, now in use The earliest designs of these used a metal spur gear for the first reduction from motor to countershaft, but as this caused noise and friction, resort was had to a gear of compressed rawbide This was a slight improvement, but still with obvious defects. Worm gears were next tried, but finally the Renault silent chain was introduced, and this has been adopted for the first reduction by most numers of bigh-grade electries. One manufacturer, however, has just announced a driving system in which the power is ransmitted to the shaft through a universal joint that forms part of the rear motor head, thus eliminating the first reduction. Particulars of this been adopted for the first reduction by most builders eliminating the first reduction Particulars of this device and of its operation will be awaited with

The second reduction from the driving shaft to the rear axie is by some designers effected through bevel gears. The success of this method depends partly upon the design of the gear teeth, partly upon pacity upon the uestign of the great teeth, partly upon the process of hardening the steel, and partly upon proper provision being made for the self-alignment of the gears In any case the gears must be com-pletely housed and should run in a continuous bath

The accompanying drawing of an electric driving system shows a double reduction drive in which the ower is transmitted first by a flexible gear to a uni-orsal shaft parallel to the rear axis and then through certail searcy parasites to one rear many and one turrough perriaphone genrs to the atle. It is well known that tears connecting parallel shafts give the highest per-entage of efficiency, while the efficiency of herring-one gears has been fully established at above 98.5 her cent. (See Scientific American for February 12th, 910)

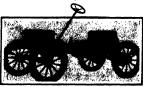
The driving axle is of the full floating type, the

axle tubes being made by swedging and upsetting the tubing in dies so as to give an extra thick wall at the point where the diameter of the tube is reduced for the eel bearings, this method being adopted to make a one-piece tube with no brasing. The driving shall



t electric pha

may be removed by taking off the dust cap and pull-ing it endwise. This allows the differential case, driving gears and pinion to be removed from the axle frame, which permits the inspection of every part, all being put together again with very little work. The flexible gear runs on a sprocket cut like a gear wheel, inclosed in a dust-proof case and runs in a con-



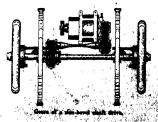
Changie of an electric carriage

tinuous bath of oil. The motor and flexible gear case are combined in a single unit and assembled on cross pieces attached to the body frame. Rubber cushions used to overcome the effects of vibration whole unit may be disconnected from the car in a few minutes' time by removing the locking screw in the universal joint, thus permitting the sleeve to be



The power plant of an electric car, The chain in front is covered with a dust-proof aluminium case.

ed from the joint and the universal shaft to be 1 out. The motor can then be dropped by retaken out. taken out. The motor can here be dropped by re-moving the two supporting rods that coannect the field frame to the motor support. The simplicity of this device for removing, inspecting and reattaching the driving system is a matter of universal interest to garage men.



Of equal importance with the congret of arched are those connected with the design of electric vahiles controller. Many of the sarily a ures of the first designers of discretics ware ordinary or the first designers of discretics ware ordinary could be sufficiently as the controller with the controller. Archae controller with the controller of missibility and investigately as in

sty toutiders and at sees the part of the or

THE CONTROLLER.

The form of controller used in in type. The particular instance where this come is used on an electric vehicle shows a core on are assembled blades of various widths and b are assembled blaces or various of two places that engage on fingers consisting of two places that engage on fingers consisting frame. The that angage on magers consusting or two propose are assembled on the controller frame. These is the knife-blade contact of liberal area with diffe speed notches. The blades are made of bress and flagers of phosphor bronze. The speed controller figures of phosphor bronze. The speed conservation also of four notches, the first two bing, resistance notches with the motor field in series, the third, said fourth with series at all times. There are four, reverse mesed similar to the four forward speeds; The verse speeds similar to the four forward speeds; method of connection is such that the circuit is ne broken after the power is once applied, giving a om-tinuous torque to the motor and preventing any jerk ing or arcing between the speed notches.

An emergency key is fitted in the top of the re-

An emergency key is fitted in the top of the re-verse lever and serves to mechanically unlock the position of the reverse lever switch. This reverse switch has three positions—ferward, neutral, and backward In the neutral position a tongue engages automatically the fixed part of the controller frame. The fary serves the purpose of disengaging this tongue, which disens the reverse switching to make the electrical common tions for either forward or backward motion, and do

way with a plug switch.

The continuous torque drum type of controller is The continuous torque drum type of controller is preferred by some engineers, and the vertical radial type by others. The resential feature of all, however, is the provision of liberal contact areas that will type vent arcing in changing speeds, and this has been so-complished in all modern types of alcetrics.

Another problem of special interest to, the designaria the steering system. A for unanthedupers use the

as the stowering system. A rew manufacturers tage the wheel steer on particular models, and owners of gaso-line cars often express a preference for this form of steering system in purchasting electrics. Combined with a practical foot control in the hands of a skillful driver, the wheel steer has undoubted advanin operation; but in ordinary use the foot control may prove a positive danger to the occupants of the car, and for that reason it has been abandoned by most designers. With the controller bandle set, for instance, signers. With the Countries under set, for insenter, so third speed, if the resistance, or foot control, suddenly applied, the car may be brought to a full stop. Then, when the foot controller back to neutral going taken to let the foot controller back to neutral go sition gradually, there will come a sudden jump into auton straumanty, there will come a sudden jump into high speed that is certain to be unpleasant and may be dangarous. For this reason most designers have abandoned the foot control as unsuitable for a carriage that may be frequently driven by women or children. Having to keep one hand constantly on the controller on discovers that the wheel steer lever, the driver soon discovers that the wheel steer is less convenient than the side lever steer, and for this reason the latter has been most generally adopted. The effort to reduce weights to the minimum has

led many gas car designers to adopt semi-alliptical aprings. The practice has also been followed by some designers of electrics; but with the shorter whool-base and the heavier weights of the electric mechanism, the slight reduction in weights gatued by the use of seni-elliptics is obtained at so great a cost in discomfort to the passenger and wear and test on tires, battery jars and the diser parts of the machine, that the most ap-proved of the later designs include the use of full proved of the later designs include the u elliptical springs with supplementary are front and rear.

Other problems having special interest for the de Other problems naving special inverses for the un-signer are, heating systemic, types of atten, tubes and bearings. Add to these the important questions con-nected with body design, fittink and furnishing, and it will be again that the designer of an electric submo-bile has blonty to occupy his time and his gray.

to extreme lightness it was util be alleged with anoth owing to its ext

Some Remarkable Mechanical Road Guides

Ingenious Devices which have been Invented to Supplant the Guide Book and Chart

By Harry W. Perry

This distribution states and datable books in a cer traversities at consistentials appear has led to be investigen of many interviews substitutes. All of from one internded to reveal the proper radar. Some of these distributionality states of them for minimal consistance. These is not one of them but presents accomplishment interview of column which about denied not ment in the case, but now many interesting the property of the interview of the

A.L. tourists by automobile know the difficulties and assnowines of sinding and keeping on the best routes to their, objective points. They early learned not to place sair dependence upon local residents for simple and 'seladable directions. Only within the last



A disk that guides you from New York to Weterbury.

two or three years has the work of sign-posting through roads been prosecuted vigorously and exestivity, the States, consities and townships pretering to leave this public work to be done by automobile other and good roads associations. Chief reliance for sure guidance has been placed upon folded road sings, route cards and route books. These contain much essential information, especially the automobile route books, but they also have certain objectionable features. They flutter and become torn in the wind, rais wets and spoils them; the bouncing and swaying of the car make it difficult to follow the directions or keep the place, and after dark they are hard to read and almost useless unless the car faited with a good savivel searchlight that can be

thrown on such sign-posts and landmarks along the way as are referred to in the book or indicated on the map.

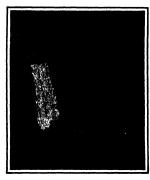
It has been the object of a number of inventors of late to overcome these difficulties and simplify the unwelcome task of finding the route by producing mechanical devices for attachment to the car that would serve to guide the motorist unerringly over any chosen route he may elect to follow. Three such instruments have been perfected and put in the market. Patients have been issued on others, and more inventors are still at work along different lines

inventors are still at work along different lines ALVING CHART.

Of those aiready available for general use, the distinction of being first in the field appears to belong to the "Live Map," as its inventor has very actly mamed it This is a very simple instrument, constiting of a fiat, circular, polished metal case about 8½ inches for diameter having a hinged glass face and containing a train of gear wheels connected to a revoluble metal center plece and to a fiethle shaft. The fiscible shaft terminates in a spor pinion carried in an adjustable bracket to be attached to the steering arm of the car, so that the pinion will mesh with and be driven by a large spur ring secured to the inside of the road wheel. The revoluble center disk in the case is provided with three steels stude so that a perforated paper disk can be slipped over them and made to revolve with the center plece. At the left side of the case is fixed an immovable steel pointer, blued to contrast with the white disk.

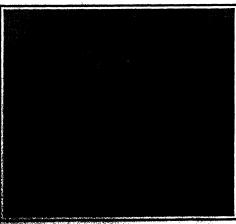
The face of the circular card is printed with a scale of miles around its perimeter resulting from 0 to 100, such mile indicated by a number and every fifth mile printed in heavy type. Intermediate fifthe of a mile are indicated by abort lines. All necessary road directions are printed in plain type on the face of the card radial to the center, with a line drawn from sach to a point on the scale corresponding to the exact distance from the starting point in miles and fifths of a mile, to which the printed direction applies. The directions are simple and concise, yet are plantiful and ample, showing exactly when and which way to turn, naming the streets take when passing through cities and towns, indicating when to cross ratificad tracks, bridges and trolleys, when te keep straight shead, and which fork to take when the road divides. Landmarks are mentioned incidentally at frequent intervals to reassure the tourist that he is still on the right read.

Assuming that the motorist starts at the exact place where the route card begins, the card is placed in the instrument with 0 immediately under the pointer Should he start at some intermediate point, however, the card is set with that point under



This road guide is fitted to the steering column and is

the pointer, a thumb acrew on the back of the instrument permitting the center piece and card to be moved at will without interfering with the driving genr. As the car travels, the dial reviews very slowly, making only one complete revolution in 100 miles, and as each separate road direction comes directly opposite the pointer, it tells the driver just how to proceed. The mechanism is made with the utmost accuracy, so that the scale on the dial will correspond exactly with the distance traveled and the poluter always show the motorist just where he is—a fact that is one of the most important features of the device, as one of the great difficulties with Continued on more 45.7.



to be desired.



A hand-adjusted guide. Method of resetting direction and mileage rings.



How the live map is attached and operated.

ć.

Why You Can Buy a Good Car for Little Money

The Mass Production of Motor Cars

By Harold Whiting Slauson

It is now possible to buy a car for less than two thousand dollars which is better than the car for which five to seven thousand dollars was paid ten years ago. To bring this about methods downed. The following article discloses the system which has made possible the modern cheep and efficient automobile. The result of the advance universal uses of small to this country has been not only to encreast the outquirt greatly and the indirectanteasebility of parts, but it has had the effect as well of sinderdefing the product of the makes

A FEW years ago a comparison of the representative merits of American and foreign cars offered no opportunity for discussion, for the latter were admittedly the superior in every way to our own products in the line. To-day, however, while it can broaders in the line local, however, while it can hardly be said that these conditions are reversed, we find the American cars at least holding their own with their foreign competitors, and in many cases demonstrating actual superiority; and so

each part. As the work is all done by hand by the individual workmen, it is small wonder that, even with the prevailing low wages, the well-built foreign car is expensive at best. These same meth-ods formerly obtained in the construction of the American car, and as the wages received by the workmen here are higher, it can be seen easily how the

the quality and serviceability of these latter-day motor cars are far superior to those of their earlier predecessors. It is the same change in method that stimulated the watch industry. To-day, in the modern automobile factory, we see the cold-chiesl and the kam-mer replaced by the power cutter and planer, the enery grisder de-tained to the file, and a multible or same drill performance ing the work of the file, and a multiple or gang drill performing operations that formerly required the use of a dozen separate drill

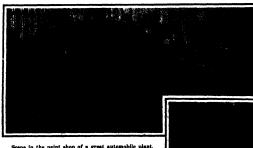
Gear-cutting machinery has been well nigh perfected for a m ber of years, and it was a comparatively easy matter to install in the progressive automebile factory such devices for the rapid prothe progressive automotic ractory such devices sof the rapid pro-duction of all spur and havel goess for the transmission, motor, and differential as were already in use in other modern shaps. In consequence of this, it is probable that the most radical changes have been made in the design of the machines used for boring and grinding the cylinders and for facing off the crank cases and lining up their hearing centers.

CTLINDER BORING.

CTLINUER RORING.

Boring the walls of a rough cylinder casting is but a glow operation at its beet, particularly if several cuts are to be taken, and
inasmuch as it is not advisable to increase the speed of the tool
beyond a certain extent, time can be saved only by working on eral castings at once. This is well accomplished in some fac-

tories by the use of a battery of double boring mills, several of which can be attended to by one man. Such a mill may consist of two spindles, parallel to each other, in each of which a boring or cutting tool is placed. These spindles are both driven by the spindes are over the everhead shaft-ing, and each bores one of two cylinders placed side by side in a fixture on a turret. Such cylinders



Scene in the paint shop of a great automobile plant.

present a foreign car must be of the very best in order to

find a profitable market in this country.

The figures show that, not only are we making automosupply practically all the users of our own country, but that we are shipping them to foreign countries to the but that we are snipping teem to foreign countries to the extent of from fitteen to twenty-two million dollars worth a year. To be sure, our sister republics in this hemis-phere provide a large market for this export trade, but the medium-priced American car is finding its way even into the very heart of the countries whence came its former competitors.

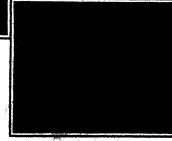
This home and foreign consumption has increased in

face of the fact that we pay our skilled labor several times what the artisans of Europe receive, and that some of our best materials are still imported and are subject to a high duty The rise of the American car in the face of these handleaps until it is now a competitor of the product of the cheaper labor of Europe is due entirely to the improvement in the shop and factory methods and to the efficient organization that the last decade has

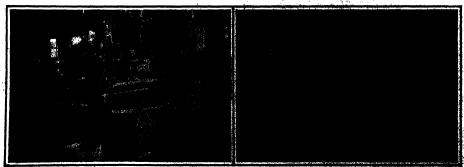
brought about. The European cars are nearly all built by skilled labor, and one might almost say that the quality of the product depends upon the personality that each mechanic puts into Infinite care and detail are bestowed upon

Automobile parts by the thou foreign-built automobile secured a firm foothold in this country.

To-day, however, the methods are so changed that the first thousand automobiles made in this country would scarcely recognize the place and manner of their birth. Instead of being built, one at a time, with infinite trouble and pains, they would find themselves me nutactured in a single day, in company with thirty or forty others—turned out of auto-matic machines, as it were; and yet



Piston-ring and other lather.



may be sant in pairs, or separately, but in either case hop can be bored at the same time, and as the speed of this two spindles and the adjustment of the two the same, the pieces will be finished together results will be identical. and the res

and the results with de identical.

While this boring operation is going on, another pair of cylinders may be fastened in the proper position to the back of the turret, ready to be swung into place as soon as the first pair is finished. The on an both sides of the turnet are so designed Strains on norm since or the turret are so designed that the cylinders may be placed in exactly the proper position with very little trouble on the part of the operator, and he is thus enabled to take care of a battery of several of these mills. Automatic stops are provided on each mill so that the feed of the spindle will come as soon as the end of the cut has been reached. The great saving in time accomplished by such a system lies in the fact that the spindles need never he idle except for the instant required to swing the turret and bring the new work into position, for the completed cylinders are removed and the third set secured in place while the boring is in progress on the second pair. The cyl-

rs used in the highpowered cars are very heavy and unwieldy, particularly if they are cast in pairs, and in order to facilitate the handling of such parts, some of the large factories are equipped with compressed air lifts by means of which the work may be raised from the floor and to the various carri machines

Nearly all cylinders for automobiles are now ground before installation ground before installation in the completed motor, an operation that doubt-less adds much to the efficiency of the modern car. Although grinding merely removes the tool marks left from the bor ing mill and makes an absolutely smooth and nearly glazed surface on the interior of the cylin-der, it would be a long and expensive process. were it not for the almost general use of a special grinding machine. The horizontal spindle set in an adjustable eccentric bearing with an autobearing with an matic, longitudinal fe its end. An emery wheel is secured to the end of the spindle, and as this is revolved rapidly on its own axis, its ecofric bearing is turned more slowly in the opposite direction, giving a circular sweep to the emery wheel. The bearing is so set that the weep corresponds in diameter with the bere of the cylinder to be ground, and as the operation pro-gresses, the emery wheel is fed into the easting. It

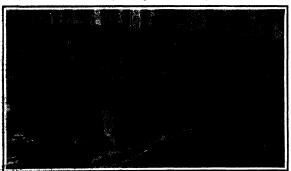
a few thousandths of an inch are desired to be ground a sev inputaments of an inch are desired to be kround of fron the wall of the cylinder, and consequently two or three repetitions of this operation are generally sufficient and a battery of these machines can easily take case of the product from several times their number of boring mills. Most of these grinders are squipped with saction air pipes that serve to sample the emery and from dust as it is produced in

the orthogen with minimum or "cartiman."
The count-dense of the halocity of automobile colored of behavior of minimum and as this is a minimum of the colored of behavior of the first of the colored of

mill and a disk to which are attached several cutting tools, the facing off of the entire surface may be done with great dispatch. This tool is known as a "cat-head," and as it revolves in a horizontal plane the bed to which the crank-case is attached is fed under it, thus facing off a surface with each cut that is as wide as the diameter of the disk, or cathead. The ends of the crank-case may be faced off in the same manner, and if it is desired to cut a flange for the forward train of gears, the separate tools of the cathead may be adjusted accordingly

The multiplicity of operations that may be performed on a single place by means of modern shop machinery is best exemplified by the treatment of the bearings for the different shafts that are located in Many motors are designed with two the crank-case. the crank-case. Many motors are designed with two cam shafts, and these, with a three or five-bearing crank shaft, may make necessary as many as fiften bearings in a single crank-case. Many of these are of different sizes, and yet machines are in use which will cut or bore all of these at once. In addition to this, some of these machines are equipped with a verti-

bly floor of a great automobile factory.



Putting chassis together. WHY YOU CAN BUY A GOOD CAR FOR LITTLE MONEY

cal spindle and cathead that will face off the upper side of the crank-case at the same time. As the various béarings of the crank-case will be located on three parallel lines corresponding to the positions that rank shaft and cam shafts will occupy when the crans sant and cam sants will occupy when as-sembled, only three spindles are necessary for this bearing-cutting machine. Each spindle is provided throughout its length with slots in which adjustable cutting tools may be placed, and by setting these at the required length, the proper cut for each bearing will be made when the spindles are removed and the

form the feed.

One of the Most useful tools brought to the aid of the automobile manufacturer, and one that enables him to turn out a great amount of high-class work in short time, is the multiple, or gang drill. The individual spindles of such a machine are connected the power shaft by a pair of universal joints, and by means of these any drill may be moved any place within a limited radius. When moved to the proper

bed to which the crank-case is secured is moved to

position the drill may be set and locked, and by taining the right combination of positions of the different drills, a set of several holes may be drilled in a surface at the same time. Absolute accuracy so far the proper location of these holes is concerned is obtained by means of a jig. By the use of one such machine, properly set, one automobile factory is en-abled to drill all four holes in the bearing caps of two connecting rods at the same time with scarcely any more trouble than would be required to bore a single hole The same type of machine, when set for single fore the same type of machine, when see to different work, can drill all the holes of different sizes necessary in the upper surface of the crank-case, and here, too, the use of a jig makes the nearly automatic results far more accurate than could ever be obtained by trusting to a workman's eye and hand

The advantage of the gang drill is particularly no the advantage of the gains and as parton as parton and the there is the the the that is, with all four cylinders cast in one piece. In one factory in which such motors are made, a double multiple drill is used with the spindles so set that every

tiple drill is used with the spindles so set that every hole required in each evillater may be drilled in two castings at once. This really means, then, that eight evilladers can re-ceive their full quota of drilled holes simultaneconstv

But all this labor-saving machinery will be of lifthe avail unless the vari ous tools are so arranged that a minimum amount of handling will be re-quired for the work. With this arrangement in view, the machine tools are ced in a relation corresponding to the progress of the work on each part, so that, as each piece is finished in one machine, it may be carried to the next adjacent machine for the succeeding opera-tion For example, near the boring milis will be found the drill presses for the cylinders, while beyond these will prob-ably be placed in order valve-pocket reamers, the shapers for facing off the bottom of the casting, and the grinding ma-chines. The crank-cases chines. The crank-cases follow the same general plan, and are so routed that each piece need only be lifted from the planer to the reamer or the duplex boring mill, and from this to the gang

This is all, of course, a matter of highly-specia workmanship. and ized each man will attend only to his own machine or battery On this account, pieces may through the hands of at least a dozen men, and when the amount of work required on each of the thousand and one separate parts of a motor car is considered, it will be realized that a great num

er of skilled artisans of various classes are required for the manufacture of a modern automobile GRINDING FOUR VALVES AT ONCE.

The extent to which quantity production has found its way into even the smallest operation of the construction of a motor is well exemplified in the facstruction or a motor is wen exemplined in the tar-tory of one of the leading automobile companies of the country. The valves of every motor must be ground before it is ready to run, and while this is not a difficult or long task, the factory has improvised a machine that will grind four valves of a motor at the same time and with no more attention from the operator than though he were confining himself to one valve. This valve grinder is in reality a converted quadruple drill press, having the spindles driven by bevel gears connected to a com-mon power shaft. The spindles are set at the proper distances apart to correspond to the valves in the pair of double-cast cylinders, and by a simple tripping device the pressure on the valves is released of frequent intervals to allow new grinding material to

(Continued on page 49.)

The Commercial Motor Truck vs. the Horse

A Comparison of Efficiencies and Costs

By Harry W. Perry

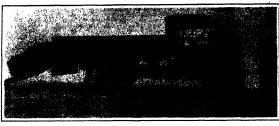
nure automobile quicken the pulse with administra, what is the mental ingression created by the makesic movement of nurban rows? The independent and certain coming and going of motor engons and trucks day in and day out in our les ni day in-butteral and commercial life. celerity of movement, the power, and the beauty of line and finish of the pleasure rying a five-ton lond of merchandise swilly through the city streets or the suburb variety of work, is one of the most impressive and significant features of presont-d

N the light of what has been accomplished by me-In the light or what has been accompissed by me-chanics in street railway service, in railroading, in shipping, and more recently in pleasure driving on the public highway, it seems absurd ever to have doubted that ultimately the mechanical transport of materials and merchandise of all sorts would super-sede their movement in the old, slow and inadequate way by horsefiesh It is visionary to assert that the ever will be wholly displaced, either for pleasure

ability to give continuous service without fatigue. ability to give continuous service without insigna-That is why we hear of the introduction of motor wagons in the postal service in many places, as in New York, Indianapolis, Detroit, Washington, Mil-waukee, and other cities and the proposal to place them on rural free delivery routes, and the adoption of self-propelled fire apparatus, police patrol wagons, and ambulances in large and amail cities.

Merchants and manufacturers may feel under a

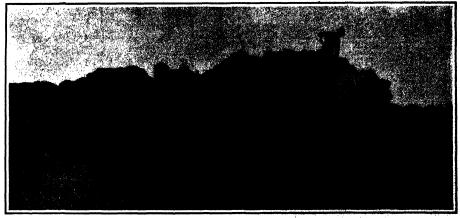
So much attention has been directed to the r cost of motor service and horse service that in the minds of many this is the chief if not the sole decid minds of many this is the chief if not the some decem-ing factor between the two. In some trades it may be quite right to make it so, but in most lisse, of business quickiness of service, range of operation, dependability, and other factors are, perhaps, of really greater importance. A mill of ractory, the 'instance, that installs the most up-to-date machinery and rapid





Unloading 3,000 pounds of pig iron from a heavy truck

A light delivery vehicle



The modern way of having. Compare the size of the truck with the size of the horse-draws wages.

THREE EXAMPLES OF THE KIND OF WORK WHICH THE AUTOMOBILE TRUCK DOES

driving or for draft purposes, but it is not too much driving or for draft purposes, but it is not too much to say that the time is not far off when no up-to-date business, dependent upon a delivery or drayage ser-vice, can afford to employ horses in or near a large city. Without doubt this will come as an unbolitevable statement to a great many persons who never have studied the subject or had opportunity to observe what is being done with motor trucks and delivery wagons in New York, Chicago, and other cities, and in many tural communities, even in remote mining districts

sortion does not necessarily mean cases a store or other business can maintain a motor delivery or transfer service at less cost than an equiva-lent horse service, but it does imply that such a business will lose trade to competitors who, by the use of motor transportation, will be able to make deliveri in less time and at greater distances, or will be able. in less time and at greater detailed, or with a given to transact a greater volume of business in a given time Federal authorities and municipal bodies throughout the length and breadth of the land have long recognized the tremendous advantages pe by the motor vehicle in the matter of speed and of

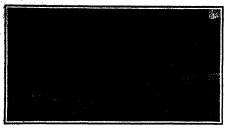
greater necessity than federal and municipal hodies to utilize the least expensive in preference to the most efficient transportation system and hence have been very conservative in regard to the adoption of com-mercial motor vehicles. But many of the most progressive private and quast-public companies in the country have adopted motor wagons and are using them with great success. Some have depended upon them for years, and a few have abandoned horses altogether. As a single instance, the second largest de-partment store in New York city depends absolutely upon gasoline trucks and electric trucks and delivery wagons for its entire transfer and delivery service which extends to points thirty miles from the stop which deliveries are made within twenty-four ours after purchases are made. With the many intaliations that have been in successful operation in wholesale and retail trade for varying periods dating back, some of them, are to tim or more years ago, sufficient data are available to any earnest inquired to convince the ressonable mind of the all-round se viceability of the industrial motor yealed.

production methods transacts its sales by telegrant production methods, transacts its sales by keight and makes shipments by express is not fullowin, very consistent policy if it hauls its shipments to express offices in alco-moving drays when meter to would take them there in one-third or one-quarter time. Even if the latter service were more it would be justified, but there in emple to-day the cost is actually less than that

system.
The inscrimitile world is really we transportation adjusted and a great de has been taken in motor business was past year than over before. This is

estines Strings have adopted spotor season hold after a fair trial, have pendented them to return to horse syrice shave then very few. It is highly indicative of present in-

"Spi algality indicative of present in-inguist in this subject that for the first time is six to seven years commercial vegicle observes have been held during been conducted with considerable suc-oses in Ethiodelphia, Borton, New York, and Chlosge. The object in all gases was to demonstrate the relia-tivity and operating economy of motor ruck and delivery wagons, both gaso-ling and, electric. The Philadelphia copiest was hold August 18th and 18th and 68 vehicles participated, running to Atlantic City the first day and re-curring to Camden, across the river



The old and new way of delivering goods.

from Philadelphia, the second day. The vehicles ranged in capacity from 600 pounds to 7 tons, and were loaded to full rated capacity. The running schedule of the largest truck was 8 miles an hour, of the intermediate sizes 10 miles, and of the light delivery sizes 10 miles, and of the light delivery wagons 12 miles. All but eight of the machines that started finished the round trip, and of the nine electric vehicles that started none failed to cover the whole route. The largest the tripresentation of any one make was twenty Autocaus, of which all but one finished. A Packer's 10 minute, load-od, made the trip one way in 1 hour, 32 minutes, exceeding the schoolie for minutes, exceeding the schedule for its class by I hour 40 minutes and also that of the iastest class. Two Fraver-









A brower's truck that has been running for nine years.

A high-wheeled gasoline delivery wagon.



Two German automobile trucks for farm use.



Depositing loads of lumber at factory site without breaking the loads.



Three-ton White gasoline truck with stake body and steel wheels.







How general transfer work is done in Cincinnati by three-ton motor trucks.

A Few Shop Jobs on an Old Car

Hints for the Man Handy with Tools

By Herbert L. Towle

The man who knows how to use his hearts and who has new machine took at he disposed can do much of his residing hisself, to be seen, there will always be jobs that will require the allest all their there is no research with the previous sensor his year branches beautiful be allevered to previous controlled coveres. The intuitions which are beautiful period inclined one way of cutting down expenses in the This articles talk how the steering gear can in most array; how leaks in the recision are over; how new cands shall bushings are filled; how the wear of platons and cylinders is remedied; how assist how koos bell beautiful; is percurse an explained; the collection of the control of the collection of the c

A SIDE from repairing actual breakages, which are not covered in this article, the work of overhauling an old car concerns itself, first, with making good wear due to use, second, with altering or modern izing certain features, such, for example, as the ignition system, to bring them up to date, and, third, with an intermediate class of repairs necessitated by such things as sagging of the frame or axles, or bends in the steering connections which cause the front wheels to run out of line. In most cases of wear or distortion, the proper remedy suggests itself at once to the experienced shop-man. In many cases, howto the experienced subplication. In many cases, how-ever, the severity of automobile service is such as to require much more careful treatment than would be necessary with other classes of machinery. A few typical instances are noted in the following para

LAKING A STESSING GEAR SNUG.

The steering gear is usually the first part of a car wear, owing to the violent shocks it must endure, and the necessarily limited sizes of the various bearings. A common fault in old cars is loosening up of the bolts holding the casing at the base of the steering column to the frame. Unless the steering column is well braced to the dash or toe-board, the alightest looseness in these bolts will cause the steer ing column to shake and the bolt holes to wear large Tightening up the bolts is but a temporary makeshift Tigorening up the source is out a temporary massessimilar the only permanent remedy is to roam the holes true and fair to the next larger size and put in bolts that are a tapping fit in the holes it may even be worth while to make special bolts for the purpose from annealed tool steel. A better remody, where it requires that the dash or toe-board itself shall be rigid A simple method is to make a brass casting to fit the dash or toe-board, having a cored hole a quarter of an inch larger than the steering column being put in place, this casting is heated, and babbitt metal is run in to fill the space around the column If the outside of the column turns, thin paper must be wrapped around it to give clearance, and the bab aring must be four or five inches long and provided with a grease cup.

In case the steering knuckles are worn loose on their pivot bolts, renewal is easy if the knuckles are bushed If, however, there are no bushings, the knuckles may be counter-bored and case-hardened bushings driven in These bushings, of course, should, be case-hardened inside only, and copper plated and wrapped with asbestos before baking to prevent their surfaces from absorbing carbon. The same treatlink, or the holes may simply be reamed true and plus made and case-hardened to fit them I I new plus are made, they should be provided with oil covers, or, better, small grease cups, and these should feed to the center of the bearing

TEAM IN MADIATOR

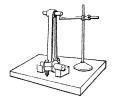
A radiator may be repaired, if the leak is outside, by emptying it and laying it flat so that the solder will not flow away. To prevent adjacent seams from opening from the heat, they may be kept cool with pads of wet waste.

NEW CRANK-SHAFT BUSHINGS.

Die-cast babbitt metal is now almost the universal material for crank-shaft bushings, and is far preferable to bronze. Quite possibly the crank pins of the engine to brouse. Quite possiny inc craik pins of the engine under consideration are oliced by splash from above, through holes drilled in the upper half of the connect-ing rod "big ends." If so, the repair man has a good opportunity to prolong the usefulness of the next good opportunity to prompt in useruiness of the next set of bushings by leaving the upper half entirely plain and feeding the oil from beneath by means of copper or steel scoops sweated into the bottom caps of the rods. These scoops should be about one-quarter of an inch inride diameter, and shaped to dip squarely into the oil. Short oil grooves should lead crosswise from the oil hele in the engier of the bushing, but these grooves should extend he more than half way to the edge of the bushing, so that the oil will not be halt to expend from the bearing withoul deplic, say part of the week. In handling connecting rods with scoops, fitted, care must be taken not to bend the end of the scoop by an accidental blow, as this would defeat the of an inch inside diameter, and shaped to dip squarely

object of the scoop and result in a cut bearing. The reason for leaving the upper half of the bushing plain is that, under pressure, oil squeezes out from a bearing instead of working into it, and grooves in the pressure side would permit the oil to escape at the very moment when it was most needed. WEAR OF PINTONS AND CYLINDERS

The niston rings will become leaky before the pistons have ceased to be a fair fit in the cylinders; consequently, replacement of the rings may be the only



Testing wrist and crank-pin bushings for parallelism after scraping the latter.

barrel-shaped, and the piston also wears, with the result of oil working up past the pistons in undue quantities, till a noticeable click is produced at each explosion by the side slap of the piston. When this point is reached, the cylinder must be reground and a new piston turned to fit. The clearance between the piston and cylinder should be approximately one thousandth inch, plus another thousandth for each inch of the piston diameter. That is, a four-inch piston should have five thousandths of an inch clearance. The top of the piston should have, when cold, at least double the clearance given elsewhere, on account of the expansion of the piston head when hot.

saddon Fiam.

A motor car frame is after all nothing but a spring,
and it sags more or less according to the load. In
time the shocks of travel may produce a permanent set in the side members, to compensate for which the motor and gear case should be lined up anew. It is a good plan when doing this to load the frame in some manner to about its normal load. If the sag is small, it can usually be corrected by putting liners under the rear feet of the engine and the front feet of the gear box. Exact alignment is unnecessary if the clutch and gear box are connected by a short shaft having universal joints at both ends. If, however, there is only one universal, or none at all, fairly exact alignment is necessary. An approximate te





Bad and good square and hexagon ends of shafts.

is had by opening all the compression cocks and turn ing the crank slowly with the clutch engaged to show whether or not there is blading at any point.

whether or not there is blading at any point. If the frampelage aggregs on much that liners used as above will not engaged the growthe. It is best to apply trues rocks andemest Hilly frame. The manner of doing this will depend on the room anglishle for staching the ende of the trees roots and foly placing; the two strues. According to the size of the extra the trues roots may be from % inch to ½ sight, it, the trues roots may be from % inches, its % inches high, it, is goes to attach, the ende of the arms.

rods beyond the spring shackles, and, if possible, over the axies. The struts may be spaced apair about one-third the distance between the ends of the rods. The rivets holding the ends of the rods should be spaced fore and aft and should be about 6/16 inch in diameter, two to four being used, according to the size of the rod. A turnbuckle in the center of the rod will draw the frame straight.

not will draw the teamle straight.

RALL BEARINGS LOOSE IN GRAE CASE.

Annular ball bearings set directly into an aluminium crank case are liable in time to hammer their aluminium seatings until the outer races are dis-tinctly loose. This is avoided in some cars by setting the bearings in bronze cages, thus distributing the contact between the outside of the cage and the aluminium over a larger surface than the outer ball race itself would afford. In case a ball bearing works loose in aluminium, the best remedy is to counter-bore the aluminium about ¼ inch larger each side, and machine a flanged bronze ring to fit the aluminium as snugly as possible.

FILLETH ON HOUARS-ENDED SHAFTS It is quite common for the shafts in live rear axies of the floating type to engage the differential gears by having square bolts milled on the shaft ends. Quite possibly the outer ends of the shafts may engage driving plates in the wheel hubs in the same manner. If the car has side chain drive, the differential shafts may have their inner ends formed in the same way. and the outer ends may have taper ends with hexag-onal flats to hold the sprocket pinions. The best modern practice is either to have the shaft enlarged, no that forming a square or hexagonal of it does not reduce its section below that of the end portions of the shaft, or to forge a disk on the end of the shaft with bolt holes or clutch claws on it, the purpose of either construction being to apply the driving force at a greater distance from the center of the shaft. If, or, the shaft is not enlarged, it is very important that the change from the reduced square to full circu-lar section be gradual, not abrupt. An abrupt shoul-der at this point concentrates the fiber stress, and results in the shaft eventually breaking under strains which it would have easily endured if large fillets were provided instead of a square shoulder The same thing applies to hexagonal ends. If the shaft is taken out in the course of overhauling, fillets can easily be put in by means of an emery wheel.

WELDING CRACKS IN ALUMINIUM CASTINGS. Until recently, it was necessary either to discard a cast aluminium part belonging to the crank case or goar case, in the event of its being cracked, or to rivet a more or less unsightly patch over the crack to close and strengthen it. Nowadays such work is done by oxy-actylene welding. The process, of course, cannot be described here, but it consists essentially in chipping a triangular groove of the width and depth of the crack, and filling this groove with molten also of the crack, and filling this groove with moiten alu-minum, flowed into it under the heat of the oxy-acety-iene blow-pipe flame. The same process is applicable to repairing cracked water lackets and occasionally cylinders, as well as repairing damage of various sorts to wrought Logon and steel. Portible apparatus for this purpose may be had in the market, and should be a part of the equipment of very first-class attemphile bart of the equipment of very first-class attemphile

EMPTITING THE DEPERSONAL. The hardest part of the differential to lubricate, and the likeliest, therefore, to wear out soes, is the "spider," on which the four small bevel pinions are carried. The spider is usually case-bardened; the pinions may or may not be bushed. Holes are usually pinions may or may not be bushed. Holes are negative divided in the pinions, through which cit is worship to the rolling of the teeth. If, however, the their miles he midstake of using groune to lond-parts the different list, the requirer is likely to find that "a brightness of the small pinions have been cut to please, owing the present specimen of the small pinions have been cut to please, owing the ground speciment of the small pinions have been cut to please, owing the present specimen of the smaller substitute of the smaller and the smaller to the smaller of the sm

ARRIVETING AN OLD PRAME,

ROOM of the frames made to-day are as strong in
privated joints as elsewhere. Occasionally, howfind a frame which through long service ogened up its joints and must be reriveted to it sound. This involves dismantling the entire and taking the frame close to a forge, as the rivetsuch taking the frame close to a forge, as the fried-shund he does hot to be secure. Before riveting, helds should be reamed to make sure that they ing evenly and are the proper size for the rivets seized. The frame members must be carefully ned after the old rivets have been cut out, as dirt

the surfaces will spoil the tightness of the

14, 141

CONTRACTION

so carefully made that they don't work loose after the car has run a few thousand miles. When that point is reached, either the operator must depend on guesswork and knack when running slowly, or springs must be attached to take up the slack and exert constant pressure in one direction. The latter excedient is simple and in most cases sufficient. However, a fir class job can be done at small expense by purchasing the ball jointed rod ends manufactured for this pur-pose and sold to the trade. These ends are usually made to serew over 3/16-inch rods, or to screw into

tubing of the same inside diameter; being of the ball joint type, they are flexible in any direction. OVERHAULING THE IGNITION SYSTEM.

The winter is the proper time for making any changes which may be desired in the ignition system. The number of reputable high-tension magnetos ut present available to the user is sufficient to afford little excuse for disappointment in this important item of equipment. If the price of a high-tension magneto is an obstacle, the user can purchase at a reasonable figure, a battery system of high-current economy and great reliability, which produces a single spark for each ignition and requires only common dry cells as a

Repainting the Old Car at Home

Suggestions for the Amateur

By Herbert L. Towle

OR a successful job of repainting, the following

- conditions are essential:

 (1) A surface perfectly free from eil or grease.
- (2) A smooth foundation on which to worl
- (3) A warm room and perfect absence of dust.
 (4) The right sort of brushes.
- (5) The right knack in handling the brushes to lay the paint, and especially the varnish, on smooth.

After washing the car, strip it of lamps, horn, speedometer, gas tank or generator, spare tire irons if removable, also the fenders, and any other attachents which would interfere with free use of a brush. ments which would interfere with free use of a brush.

Go over the paint surfaces where necessary with
clean waste and gasoline to remove every trace of
grease and dirt, else the paint will not stick. If some
of the old varnish gloss remains, roughen it slightly with the finest sandpaper or with wet powdered pumice on a wet rag. Wipe the pumice ousing a toothbrush if necessary in the cracks.

If touching-up and varnishing are all that are neces-sary, match the color exactly, using a vehicle of one raw linseed oil to three parts turpentine, and ap ply as required. Stir the paint thoroughly before using Wipe the edges of the paint areas smooth with a soft rag. Use a soft, flat camel's hair brush, 2 or 2½ inches wide, with the bristles set in glue, and work it in horizontal strokes. A great deal depends on the handling of the brushes and on laying on the right of material. Too little material or too much pressure causes the hairs to separate, leaving brush Too much material results in sags and runs, ly on vertical surfaces. The best plan is to cially on vertical surfaces. dip the brush, wipe it out slightly according to the area of surface to be touched up at one dipping, and lay the color on with vertical strokes. After the paint is worked out of the brush, but before the hairs begin to separate, go over the surface again to straighten it, to separate, go over the strates again to students, to using very light horizontal strokes. Work from the top down where practicable, in order to go over any paint that may have run from the brush. Wipe up fresh drops with a rag if necessary, but carefully avoid allowing drops to fall on freshly painted sur-

Clean the brush in turpentine, if it is desired to use it later. Stand or hang it in a covered jar with enough raw linseed oil to cover the bristles.

Let the retouching coat dry over night or longer, and rub it smooth with a slab or rubbing felt scaked in water and dipped in wet pumice. Wash clean and wipe dry. Allow several hours for the water to dry out, and apply to the body and bonnet a coat of rubbing varnish, preferably tinted slightly to match the body shade. Use the sortest possible flat camel's hair brush as before, but not the same brush. Choose a warm day or have the garage warmed. sprinkle the floor freely with wet sawdust and sweep it up. That the body before you begin, and shake the dust cloth cutdoors—not indoors. Have the garage four shut to exclude dust, and if artificial light is equired, one it freely, as otherwise spots may be

its.

The varieth will begin to set very quickly, so that it work is hosessary. When correctly applied, it is not a support of the property of material it have in the brush, are even important as regards the variations of persistence of the property of material is regards the variations of persistence of the property of the property

do not develop for some minutes after the material is applied, so that they are easily overlooked. The var-nish should be laid on quickly with vertical strokes, where the larger surfaces are concerned, and at once straightened with very light and even horizontal strokes. Avoid applying an excess of material in one spot and a deficiency in another. Avoid, also, leaving an unfinished portion and returning to it a few min utes later, as by that time the varnish will have begun to set and will show brush marks when again touched Take a panel at a time and work from the top down Glance frequently at the surface varnished a few minutes before, and if a sag or run has started, wipe out the brush and go over it very delicately to straighten

If a run is discovered, wet a rag in turpenting wine it off, avoiding a smear, and run the brush lightly over the spot. It is inevitable, however, t marks will show somewhat after doing this. ber that the surface will largely be what the brush makes it, and that too much reliance must not be placed on the tendency of the material to flow

Clean the brush in turpentine and leave it soaking in turpentine while the rubbing coat is hardening Give the rubbing varnish a week to harden, and then rub it down with wet pumice, moving the felt back and forth in straight lines—not in circles. This should give a surface smooth enough for the finishing var-nish. The same brush can be used for the rubbing and finishing varnish coats, by washing it in turnen tine after the rubbing coat and letting it stand the bristles covered with turpentine The finishing coat acts under the brush like the rubbing coat must be worked rapidly, and brushed straight with a very delicate touch after it has been spread. A warm room and extreme precautions against dust are neces-Parts such as the mud guards, bonnet, etc., which can be removed and laid approximately flat, will give better results when thus treated, since the mcy of the material to run is greatest on a vertical surface, and negligible on a horizontal surface. The finishing coat, like the rubbing coat, should stand at least a week before using, and it is well to shower it with cold water to harden it before the car is first taken out.

If the car is to be repainted, much work is required, the number of coats and proparatory work depending on whether the color is to be changed and on the condition of the old coat The standard procedure is egin by sand-papering all over, and to prime white lead and any suitable pigment mixed in the white lead and any suitable pagents mixed in the proportion of one part of raw linesed oil to three parts of turpentine. After drying, which takes a day or two, the rough spots are filled with putty, which is knifed down as smooth as possible. Allow the putty three or four days to harden, and sand-naper it lightly medium sand-paper, being careful not to fiske it Next apply three or four coats of rough stuff, as it is called, consisting of equal parts of dry filler as it is called, consisting of equal parts of dry filler and white jead worked into a stift pasts in equal parts of rubbing varsish and japan, and thinned with tur-penties. This rough stuff can be purchased ready mised. Each coat of rough stuff is allowed a day to dry, and the costs are laid crossing each othe sive an even surface.

Next apply a "guide coat" to assist in rubbing down. This coat is prepared by adding a red or yellow pigment to the rough stuff and thinning as reyour progress to the rough state and telling as re-quired with turpentine. The rubbing is done as above, until a smooth surface is reached. The body is now ready for solar coats, of which there should be one and a coat of subbing varnish, or two color coats, to be followed by one coat of finishing varnish

The treatment of the chassis is simpler, as extreme

smoothness is not expected. Sand-paper it smooth putty if necessary, and apply two color coats and finishing varnish as above described. To varnish the wheels, jack them up and take the inner surfaces of spokes, bub, and rim first. After varnishing part of the wheel, give it a half turn to start the varnish in the other direction, thus preventing runs
The writer has had good success with a painting

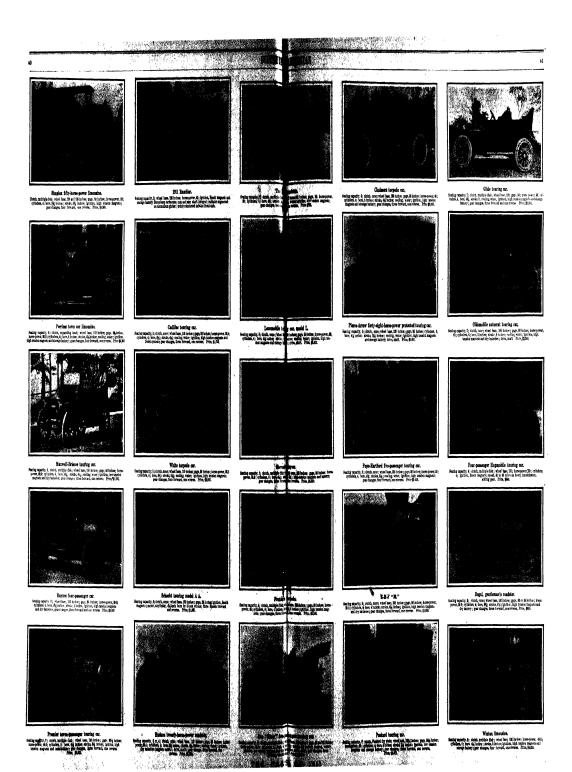
system prepared and sold especially for amateurs, and consisting of one flat coat, drying in twenty-four bours, a glossy second coat, also drying in twenty-four hours, and the finishing varnish. The first coat in this system is intended merely to give a uniform color foundation, over which to apply the second coat, which is semi-transparent. The final tint, therefore, depends somewhat on the shade of color beneath it. As the first coat does not necessarily match the second coat exactly, and as the system may be applied to change the color of a car completely, it follows that no rub-bing can safely be done on either the first or second coats, since if the coat were rubbed through, a differ-ent color would show beneath In case the old surface is in poor condition, or the unpractised hand of the leaves noticeable brush marks in the first two coats, the job is improved by one or two coats of tinted rubbing varnish applied after the second coat, and rubbed down smooth. This was used by the writer and the result was very satisfactory.

One thing that the novice cannot do is to stripe successfully This difficulty is avoided by outlining the dash, fenders, and other parts in flat black, before the finishing varnish is applied Much or little of this outlining may be done at discretion, but the result is generally best when the outlining is done sparingly. s generary peak when the outlining is none sparingly.

Such parts as the oil lamp and hood brackets can be painted black, and the heads of the hub boits can be marked with black dots. The flat black is applied with a quili pencil, the surplus material being worked out on a piece of glass or tin. The varnish brush may be cleaned in turpentine and preserved indefi-nitely in linseed oil for further use, like the paint brush If a supply of color and varnish is left over it is very easy to retouch and varnish the car at the end of the searon, thus keeping it in good condition

Official Meteorological Summary, New York, N. Y., December, 1910

TMOSPHERIC pressure. Highest, 30.77, lower 29.42; mean, 30.06 Temperature: Highest, 53; date, 3rd; lowest, 9; date, 16th; mean of warmest day, 44, date, 29th; coolest day, 14; date, 16th, mean of maximum for the month, 34 5; mean of minimum, 21.5; absolute mean, 28.0; normal, 34.4; average daily deficiency compared with the mean of 40 years, 6.4 Warmest mean, 42, in 1891; coldest, 25, in 1876; absolute maxi mum and minimum for 40 years, 68 and -6 daily excess since January 1st, 14 Precipitation, 1.95; greatest in 24 hours, 0.82, date, 24th. Average for December for 40 years, 3.45 Greatost precipitation, 6.86, in 1884; loast, 0.95, 1877. Wind Prevailing direction, West; total movement, 10,555, average hourly rection, west; total movement, (1,20), average nourly velocity, 142 miles; maximum velocity, 163 miles and hour, Weather: Clear days, 12, partly cloudy, 8; cloudy, 11; on which 001 inch or more of precipitation occurred, 9. Relative humidity, mean of 8 A M and 8 P. M., 67.9. Bnowfall, 8.9. Bleet, 38th.



The Small, Inexpensive Garage

Knockdown and Unit Type of Portable Structures for the Man of Moderate Means

By H P Wilkin

WITH the increasing use of the automobile it is becoming mo e and more the custom to house

the machine on the premises of the owner particularly in rural and suburban places where the owner finds it more convenient and econom ical to keep the car at home. He saves from \$10 it \$20 a month on storage and chaning knows it as will not be taken out with out his 1 rmission for Joy ridins, and has it always lardy for us and inspection this 1 rotatility it he he us ling an especially lestical middlen at the not of a long ride who n wants to get warm d up wash d and life dry chean tothes with the heat jossible delay. The practice of keeping the car at home is more practical and satisfactory now them. \$10 to \$20 a month on storage and cleaning

is more practi at and satisfactory now than in form 1 years since automobiles have been brought to a degree of reliability and dura bility that mak a frequent and extensive repairing unn essary. The average owner of a runabout or small touring ear finds it no very troublesom task to clean and ad just his car as use and direumstances demand or if his premises are large enough to warrant employing a man for general work the cleaning of the ar at least can be delegated to him safely if he possesses ordinary intelligence

Usually in suburban pla s () the outly

ing residential parts of cities the distance to a public garage is not great and for that reason to a public garage is not great and for that reason there is no need to provide extensive repair facilities in the private garage. They can be of the simplest nature inexpensive and occupy very little room in fact can be disposed on an ordinary workbench and in a small wall cabinet. Consequently the structure for housing the automobile does not need to be any larger than will afford protection to the machine and freedom of action for cleaning oiling and ad

There are often numerous objections to building a permanent private garage. The arryices of an archi-tect might be required construction might take too

long and the noise and debris of building would be objectionable. More important than these considera tions however may be the fact that the possessor or



A portable fireproof garage made of metal

intending purchaser of the automobile is only a ten ant and does not care to spend several hundred dollars on the construction of a special garage that must be left behind and become a total loss to him in event of a change of residence

ADVANTACE OF THE HOME GARAGE This situation is very nicely met by the portable or knockdown garage a construction that has come into widespread and common use among motorists
The advantages of the portable garage are so generally recognized that more than a score of manufacturing companies in the United States have found it worth

their while to (ater to the wants of automobilists n this line. These are scattered all the way from Port land Me to Seat tle Wash a num ber being located close to the source of lumber supply in Maine Michigan Minnesota and Washington The great majority of portable garages are made of wood although there are several companies t h a t produce such gar ages of fireproof material such as galvanized

and pressed steel The portable garage is generally used for housing one and sometimes two cars but it can be bought in a variety of styles and sizes and

is in fact usually of such construction that the dimensions can be increased indefinitely, at least in one direction by adding units to the walls and roof. They are so simple to put together and such explicit directions for erecting are sent to the purchaser when shipping the sections, that expert carpen ters do not need to be hired but when carpenters are hired they can creet the garage in a day or two at an expense of about \$25

Added to the advantages already pointed out is the fact that the cost of one of these garages erected and ready for use, is usually considerably less than the cost of build ing a permanent garage of equal size, ser viceability and appearance Knockdown or sectional garages can be bought at prices ranging from \$135 for one 9 by 13 feet outside measurement with gable roof doublehinged doors and three windows to \$465 for a double or two-car garage of the same construction measuring 18 by 20 feet fitted with two sets of glass paneled doors and provided with a sleeping room 7 by 9 feet or a chauffeur in the rear Probably the most inexpensive garage is one coating \$175, which has dimensions of 14 by 20 feet gable

roof six windows double entrance doors and a side door a two-foot wide workbench about 10 feet long and a five-shelf cupboard with binged doors. This garage has one coat of priming paint and needs on one finishing coat after it has been erected Firepro one finishing coat after it has been erected Firsproof metal garages 10 by 14 feet with gable roof one pair of end doors one window but no floor can be bought for sild or one 16 by 20 feet for \$280 The material is galvanized iron and steel which does not need to be painted unless desired and the roof panels are fluted and the wall panels embossed By way of comparison with these prices it may be

(Continu d n page 1)



A well-designed concrete garage.



An inexpensive garage of good design.



A small artistic garage of wood and stucco.



The Tragic End of Moisant and Hoxsey

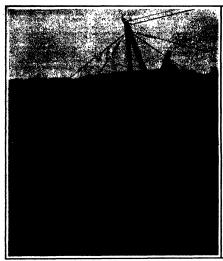
How Two Famous Aviators Met Their Death

THE general rush for records by many of the leading aviators during the last days of the year, qualited in two calamities to American aviators in the United States. Two of our most world-renowned and during airmen lost their lives almost instantaneously, case in the morning and the other in the afternoon of Freenths 2.1.

Of the two aviators referred to, the portraits of whom we present herewith Mr. John B. Moisant was probably the most skilled in the operation, at any rate, of a monoplane, and he had made a reputation in a very few months second to none of the foreign aviators. Starting with his great flight from Paris to London with a passenger in August (which was accomplished after he had been in the machine but thrice before) Mr. Moisant followed this up with memorous thrilling and darieng flights at the Belmont Park meet and subsequently throughout the South at a number of prominent cities where he was touring with his foreign associates The opening day of the meet at Belmont Park he made a successful cross-meet at Belmont Park he made a successful cross-meet at Belmont Park he made a successful cross-meet at Belmont Park he made as successful cross-meet at Belmont Park he made a successful cross-

New Orleans. The course had been marked off, and the officials were on hand early in the morning Shortly after 9 A. M. Moisant arrived in his machine from the city. A light wind of 12 miles an hour was blowing. He circled the field twice at about 200 feet clevation and then shot down at a sharp angle while going with the wind. When within 75 feet of the ground the angle of descent of the machine suddenly increased to practically 90 deg, or, in other words, the monoplane assumed a vertical position and for the ground striking headed. Moisant, according to creditable on-lookers, shot out from his machine as from a catapult while it was still in the air and dropping vertically toward the earth. He struck on his head and his neck was broken, so that he died in a few nimutes. He was 35 teet away from his machine and in front of it. The machine was not as heldy danaged as was one of his other machines in which he plunged to earth at Heimont Park before the meet, and had he managed to keep his soat it is probable to explain not have been killed. It is very difficult to explain

the aeroplane would descend to earth at a good gliding angle and would hand without mash. Whether the aerelient was due to fains thin, or not, e not known at the present time. Mr Howev we the team-mate of the late Raphy Johnston. After Johnstone's death Hoxey Tell that the demonstratin of the Wight Hoxey Tell the started in an extremt b heavy wind and the distant mountains. When returning he was voic the distant mountains. When returning he was voic taken by a snow storm, but he landed safely atter a 33-minute flight. Prevlously, at Belmont Park, he and Johnston: had each kept alort while drives backward across country 25, and 60 miles respectively by a rounle gale a performance which was one of the best of the year, and probably the greatest. He also won to follially the private this received with an actual time in the ain of Ts₂ hours, although he was allowed but 62; He further seemed fourth place in the allowed but 62; He further seemed fourth place in the allowed but 62; He further seemed fourth place in the allowed but 62; He further seemed fourth place in the allowed but 62; He further seemed fourth place in the other seemed fourth place in the allowed but 62; He further seemed fourth place in the allowed but 62; He further seemed fourth place in the other seemed fourth place in the allowed but 62; He further seemed fourth place in the allowed but 62; He further seemed fourth place in the allowed but 67; He further seemed fourth place in the allowed but 67; He further seemed fourth place in the allowed but 67; He further seemed fourth place in the allowed but 67; He further seemed fourth place in the se





John R. Moisant in his Bleriot monoplane

Archie Hoxsey in a Wright biplane.

TWO LEADING AMERICAN AVIATORS WHO RECENTLY LOST THEIR LIVES

country flight of about 25 miles in fog and rain, thus demonstrating the capabilities of an acrojulane lo bad weather, while the last official day of the meet he made his daring flight to the Statue of Liberty, passing twice over Brooklyn and winning from Grahams. White by but 45 seconds. This race was protested the Highlight aviator and Moisant had not been awarded the \$10,000 prize up to the time of his death Grahams-White used a 100-borre-power Bidrict monoplane and took a roundabout course. Moisant's machine had been damaged by a collision early-in the afternoon, but he negotiated with Leblaine, secured his 50-horse-power racer, started off at the eleventh hour, and won the race. Grahams-White was fairly beaten, but he protested on the ground that the race should have been open on the following key, as that was really the last day of the meet. When offered a chance to try again, however, he did not take it.

In his flights in the wouthern cities Moisant flow with all the shandon of his nature. He was perfectly at home in his Bleriot monoplease and never expected to meet flessit, in his muchines. At Richmond, Memsick, and New Criesans he needs thrilling flights above the cities. At the instrument place he several times shoulded to hispities of \$100 or \$1000 test, and two large better by death he flow for 31 minutes in a partice male, dering which there his machine hobbed death dide a least in an angry wind, yet without mismical flow a least in an angry wind, yet without miscolor flowers. The head arranged to try for production trophy shore a field some ten miles from how he was thrown out of the machine while it was still in the air, and this is the first accident on record in which an aviator has been thrown out unawares.

In the afternoon of the same day, Saturday, December 31st, at Los Angeles, Cal. aviator Archie Hoxsey made an ascent of 7,142 feet in his Wright biplane at the Los Angeles meet Only a few days before, on the Monday preceding (December 26th), he had made his wonderful new altitude record of 11,474 feet, and almost daily thereafter he had ascended to heights in that neighborhood. Two days before he had passed 4,700 feet above Mount Wilson, making a total eleva-tion of 10,005 feet, and even the day before he had ated this performance, reaching 10,575 feet. He went aloft on the last day of the year against the ous currents and whirls. Latham stated aft ward that he had never before experienced such dangerous air currents. Hoxsey ascended and performed evolutions for over an hour and reached a height of 7,142 feet. He was descending and had come within 500 feet of the earth when suddenly his machine was n to plunge downward at terrific speed and possibly to turn over. It struck the ground with a crash and Hovsey was instantly killed. At the present writing no definite report of this accident has from reliable witnesses, and the Wright brothers canfrom rename witnesses, and the wright brothers can-not conceive what caused it. Their machine, they claim, is so well balanced that even should the wires that control the herisontal rudder at the rear break, heid, III., to Kinhoch Park at St. Louis, a total distance of about 110 miles. He circled above Staunton, III., the town where he was born twenty-six y-wars before, or noute. While at St. Louis Hozsey took aloft ex-Preside dent Roosevely, on October 27th last, the date of his and the ex-th-esident's birthdays. Hoxsey also held the American record for endurance. This new record of 3 hours and 17 minutes was made at Los Angeles, only a few days before the end of the year.

The loss of these two leading aviators, as well as that of Johnstone, will probably tend to retard aviation in America. Consideration should be taken of the facts, however, that in the cases of Johnstone and Hoxsey the accidents were due, in all probability, to famey Bying and the performing of daring feats, whereas in the case of Moisant the accident was but an illustration of the old saying that "familiarity breeds contompt." Moisant was so thoroughly at home in his machine that he was careless in his manipulation of it and he took chances in alighting with the wind, etc. that no prudent man would take the far as the use of the seropian for logithmate girtisportation is concerned, it is interesting to note that according to Robert Lorratine, the actor-aviator, who few across the Irish Sea, but two of the score and a half killed last year met death in cross-counts fring, as soon as the groncope has been demonstrated on an seroplane as an effective stability. In averaging the machine almost as readily as he flows he automobile

Automobile Cylinder Lubricating Oils

What the Automobile User Should Know About Them

By John C. Sparks

THE proper lubrication of the cylinders of automobiles is a subject of great importance to eve one ho owns or operates a car In the first place the lubrication has to be accomplished at high temperatures, in a confined space in which an explosion takes place at every fourth stoke of the piston, and the portion of the lubricant that is vaporized on account of the high temperature is violently expelled during the exhaust stroke A number of suitable methods are used to introduce the lubricant properly, in proper quantities, to the surfaces requiring lubrication, and in this brief article we will consider only the main requirements of a desirable lubricating material, the manner in which it may be tested in a simple way, and a consideration of the conditions under which th work must be done

Some time ago I made a series of tests on internal combustion engines of the automobile type to ascercombustion engines of the automonia type to accer-tain the temperature of the walls of the cylinder and of the piston head. Even where the piston was water lacketed and excess sensible heat removed by this means, the temperature of the walls of the cylinder varied between 550 and 680 deg F. The heat is quickly removed by means of the circulating water, but is also very quickly applied and re-absorbed by the walls, so that while there are rapid fluctuations of temperature, the fluctuations occur so quickly that practically a constant temperature is maintained. The temperature of the explosion of the gasoline vapors is in the neighborhood of 1,300 deg F., so that a portion of the lubricant is exposed to this temperature for a short time, and most of the lubricant is exposed to a temperature of from 550 deg to 680 deg F during the temperature of romains and the source of the manner of time it remains in the evilinder. On this account an oil that vaporizes at a relatively high temperature is required to do this work. It has been found that oils with a flash test, that is to say, the point at which they give off inflammable vapors, of 400 deg. F. maintain their liquid body for a sufficient length of time to perform the lubrication. Therefore one of the first requirements for a suitable automobile cylinder oil is that the flash test shall not be lower than 400

It is usual in describing an oil to mention both the flash test and the fire test, the latter being the tem-perature at which the oil will give off sufficient vapor to remain continuously alight. As the first test is very dependent on the flash test and is more dangerous to take, I do not think it at all necessary to lay any par-ticular stress on it. In oils of approximately 400 deg. F. flash test, it is usually found that the fire test is from 50 to 60 degrees above the temperature of the flash, and therefore a consideration of the flash is sufficient for the user of the product.

One of the means of estimating the value of an oil for lubrication is to take what is called the viscosity of the oil. The viscosity of any liquid is the relation between the cohesion of the individual particles of licuid to one another and the adhesion of particles of the liquid to the surfaces with which it may be brought in contact. The viscosity of an oil decreases very quickly when it is raised in temperature, and as all the work done in a gas engine is done at a high temperature, the viscosity should be fairly high at high temperatures.

scosity is only a relative means of comparing oil and as it is not possible for the user of automobile oils to make this comparison at the temperature at which the work is done it is best to consider the viscosity

of an oil at the temperature of boiling water, that is to say, ' deg F Other considerations being equal, the oil which at this temperature has the greatest amount of viscosity will probably do the greatest amount of lubrication at the higher temperature under which the work must be done. This consideration has very distinct limitations due to the fact that the oil when cold must be of such consistency and sufficiently low in viscosity to be easily fed by whatever means of the mechanical system used for introduc-ing the oil into the cylinders. Therefore when comparing the viscosity of an oil at 212 deg. F. it is proper to take into consideration that the oil should not be too viscous at low temperatures. This may be tried out by heating two samples of oil in a water bath until both samples have reached the temperature of 212 deg. F. and then drawing fifty cubic centimeters of the oil into a fifty cubic centimeter glass pipet and observing the number of seconds taken for the oil to flow out of the pipette. This same operation is followed through with the other oil to be compared and an . pproximate idea of the relative viscosity arrived at

In the laboratory very much more accurate and careful methods are followed to determine the viscosity accurately, especially to maintain an even temperature and have the test performed under standard conditions with proper apparatus specially designed for this purpose, but the average user of an automobile does wish to do laboratory tests on oils and wishes to have fair idea of the subject by practical means

In addition to the viscosity not being too high at atmospheric temperatures the cold test, or congealing point of the oil, should not be high enough to prevent the oil flowing at winter temperatures. This can be easily checked by placing a small quantity of oil in a four-ounce bottle, inserting a thermometer, placing the bottle in a mixture of ice and salt and observing the temperature at which the oil ceases to flow

The gravity of oils is an item worth considering, and can be readily ascertained by means of an hydrometer This test should take place at 60 deg. F., and the specific gravity of the oil should be between 0 870 and 0 900 where water is considered one. first requisites of an oil suitable for this pur pose is that it shall be strictly a mineral oil containing no animal or vegetable oils and that it shall be a paraffine base oil and not an asphaltum base oil This fact leads us to one of the most important considera-tions of this type of oil, which is that under the conditions existing in an automobile cylinder oil in active operation, a small a quantity as possible of carbon should be deposited when the oil is vaporized. Animal and vegetable oils leave a greater proportion of carbon than mineral oils Paraffine base oils leave a smaller proportion than asphaltum base oils, and this on of the differentiation given. It is only in recent years that a proper consideration has been given to this subject. In the early days of the automobile one of the main troubles was the covering of the spark plug with carbon and the subsequent fail-ure of the spark plug to perform its work. Nowadays, due to the great improvement that has taken place in this class of oil, trouble from this cause is relatively

Considering only the paraffine base oil, the of carbon left on evaporation in the automobile cylinders will vary for different oils. We will consider for a moment the origin and reason for the deposit of

carbon. Hydro-carbon mineral cils, as the m carbon. Hydro-carbon mineral cust, as any many pines, consist of hydrogen and carbon combined avarying proportions according to the quality of the cit. In all olis there is, to a greater or lesser extent, a pdition of carbon partly or wholly dissociated from the hydrogen. When the cil is heated to a high temperature more of the carbon becomes dissociated from the hydrogen and changes from a liquid, in which form can be vaporised, into a solid form, in which it cannot he vanorized and is therefore left behind in the crim der when the balance of the oil is vaporised and expelled with the exhaust. The carbon thus dissociated pelled with the exhaust. The carpon runs unscanning left in the cylinder and collects in small nodules as the piston head, and on account of the high temperature, the nodules will glow and cause premature delosions of the gas vapors.

I first pointed out the necessity of a study of the

i have pointed out the necessity of a study of tass subject when considering gas engine cylinder oil, asid worked out a proper method for performing this test under conditions similar to those which occur in the cylinder when running. Since that time this test has been used generally by manufacturers of this product and has resulted in a great improvement in all the offe used for this purpose This test is performed at an temperature of about 800 deg. F. by vaporising the oil in a closed glass container. The container is weighed, a quantity of oil, approximately fifty c centimeter, is introduced and again weighed and the heat continued until all the oil is vaporised and the carbon is left in the container. When this weight hecomes constant the container is again weighed, and by computing the weight of the carbon left in relation to the weight of the oil taken, the percentage of the carbon on evaporation is ascertained, and an idea as to the quality of the oil from this consideration taken. The Association of Licensed Automobile Man turers have recognized the importance of this test, and in their specifications for materials, state that an off used for gas engine lubrication should not show more than 1 per cent of carbon left on evaporation. This test requires a great deal of care, and I do not see how it is possible to do it except in a laboratory, as the weights have to be determined very accurately and the glass container handled carefully both in applying the east and in manipulation. I feel that this test is eff great importance, and that the user of automobile offs should be informed by the manufacturers exactly what carbon on evaporation is contained in the oil in esactly the same way that other materials used for the manufacture of automobiles are guaranteed to be up to certain definite specifications.

Taking the main points we have considered, an off suitable for gas engine lubrication should be strictly a mineral oil, free from any animal or vegetable oils, should be a paraffine base oil and not an asphaltum base oil. The gravity can range through a fairly wide degree between 0.870 and 0.900. The fissh test, or the point at which the inflammable vapor comes from the oil, should not be lower than 400 deg. F. The viscosity should be relatively high at a high temperature, that asould be relatively nigh at a light temperature, that is to say, approximately fifty-five seconds by the Say-big Viscosimeter at 212 deg. F., and should not be too high to prevent the easy flowing of the oil at atmospheric temperatures. The cold test, or congealing point, should not be too high for the same reason. In segard to the carbon left on evaporation, the carbon should not exceed one per cent, and the lower the per when the test is taken under standard ctions, the relatively better is the oil.

The Motorcycles of 1911

THE year 1911 opens for the motorcycle with much promise The motorcycle seems to have earned for itself a definite place, for we find that it is used by merchants, messengers, rural mail carriers, and even physicians Naturally these commercial users demand a machine that will be reliable and comfort able, a demand which has brought some of the best mechanical engineers into the motorcycle industry.

As a whole, the machine of 1911 will be heavier than its predecessors Attempts to employ the me-chanical oiler, which met with indifferent success in 1910, are not likely to be repeated. Only two wellknown firms will continue to use mechanical oilers

The low saddle position, the long wheel base, and suitably shaped handle bars will greatly add to the riders comfort in the machines which will be designed for 1911.

Mechanically interesting in the new models are the absolute control of the motor by turning the grips; ample power at slow speed, so that the machine can

travel on crowded streets; free engine devices, which now seem to have been brought to a trustworthy stage; and the elimination of that disagreeable noise, which has perhaps, more than any other feature, militated against the motorcycle. A good number without a cut-out eliminates this noise and more than

ne manufacturer will so equip his machines.

Generous gasoline and lubricating oil capacity is much in evidence in the new models. The result is that the operator is enabled to make long trips with-

out losing time and refilling tanks.

Soveral types of spring forks have been perfected, with the result that the machine will be more comfortable and will be subjected to less wear.

The transmission is still another important feature that has received attention. With the improved twin roller chain and special waterproof-tanged leather belts that are now being made, transmission troubles betts that are now being made, transmission trombuses are very slight, if any degree of care is exercised in operating the machine. Both types have proved makin-factory and are equally popular. Extremes of speed, we are glied to note, are that in

great demand. Riders are beginning to realize that reliability is of much more importance than speed.

Much attention, states the Railway News, is being paid in Queensiand to the linking up of the three trenk lines which form the railway system of the colony. The matter is of great importance to those engaged in pastoral pursuits, and probably is no less interesting to those who may intend enhancing the interesting to those who may intend enhancing the that and other industries, for the linking up would pope a bit of rich country. Queenslanders are beginning to realize that the line to be built for linking one purposes sheard also be a restrict of the mode-alliest of transcontinents railway, and these seems to be owned, and the contract of the link to be proposed beginning to realize the proposed that the fort the first be built the proposed Queenslant links are extended edition from the restrict of the Northern Springers. These is the burdless of the Morthern Springers of the Morthern Springers of the Morthern Springers of the state of the Northern Springers of the Morthern Springers of the Springers of the Morthern Springers of the Morther paid in Queensland to the linking up of the the

(Cashanes From page 20.)

therefore, the height and breadth
a senselining far or "san" are ala the same, and the only variation
in the width of the container,
in must be increased or decreased acis to the number of plates in the to describe the A-1 cell. There are manufactured two cells with ler plates, for ignition and other work, the B-2 and B-4 cells, rated

light work, the B-2 and B-4 cells, rated at 40 and 80 ampere-hours respectively. The table below gives the dimensions 4 the output of the three sizes of

	A-4.	A-6.	A-8.
Outside measurement of j	8/4 ×	82 × 54 × 181	4[× 5] × 19]
Height to top of pole, inches. Weight of complete single	184	182	182
cell pounds	18,84	19.00	95 OO
Pounds per cell of a Standard assembled bat- tery	14 21	90,09	91,15
Average voltage at normal	80	45	60
rate	1.2	1.2	12
Based watt-hour output.	150 18J	2535 970	8'X0 860

In accordance with the low weight of the cell, obtained by the special voltate sination described, a very light but strong wood battery trap is employed. of skeleton construction and with beut wood instead of devetailed corners. membled vehicle battery is claimed to weigh not much more than half as much as a lead battery of the same output— a 64-cell battery for a one-ton truck reighing 900 pounds, as compared with 1,550 pounds in a 44-cell lead battery of me capacity.

The A-4 Edison cell consists of the fol-lowing parts: The can, a sheet steel receptacle containing the element and electrolyte, and having a top fitted with stuffing boxes for the positive and nega-tive terminal posts, and with a gas valve and filling aperture; the element, con-sisting of a group of positive plates containing the nickel active material and connected in multiple with the positive terminal by a nickel-plated steel bolt and e group being intermeshed with a group of negative plates containing the fron active material and similarly connected in multiple and with the nega-tive terminal; and the electrolyte, consisting of a 21 per cent solution of pure potassium hydrate (caustic potash) in

The metal of the cell is all nickeled iron, so that a pure nickel surface is everywhere presented, protecting the other visible materal is the hard rubber other visine materal is the hard rubber of the stuffing boxes and the soft-rubber top of the filling aperture. The can is of sheet steel, with corrugated walls to give the greatest stiffness with minimum weight. The seams are welded by from leakage that might otherwise de-velop from the severe mechanical vibra-tion and shocks which a vehicle battery receives. The can is embossed in places eive hard-rabber buttons, to m tain a slight separation or air-gap becan to its proper place on the wood containing the set of cells.

To the automobile owner the vehicle battery certainly looks good. A com-pact set of metal cans, with no chance of stopping or breaking. The battery has more the appearance of road service, and smacks less of the electrical laboratory, and this highly mechanical look is d by the internal construction of the element as a working electrochemi-The positive plates, conthe active material. The grid is a tripite during charpe, eliminates luming reciping material. The grid is a tripite during charpe, eliminates luming reciping to the cells, minimises the amount of the cells, minimises the amount of seasons to the cells in the cells in the cells in the cells. The unassessary to add anything but distilled

tubes are of very thin sheet steel, per-forsted with small holes, and packed or "konded" (very tightly by special ma-chines) with nickel hydrate, interspersed with pure nickel in the form of flakes of extreme thinness. The tubes are formed with a double-lapped spiral seam, and are reinforced by rings or ferrules which maintain internal contact between the nickel hydrate and flake nickel and the internal walls of the tube by preventing bulging of the tube by expansion of its contents This construction is one of the radical improvements over the old Edison cell. The problem was to bring every part of the hydrate n the plate into active service by insuring permanent electrical contact with its con necting grid, and this result is attained by the thin disks of nickel stacked in the tube in alternation with the layers of hydrate, forming the tube into a mass of intimate physical and electrical contacts between hydrate and nickel and l tween the edges of the nickel disks and forated wall of the tube; at the same time permitting intimate contact with the electrolyte in which the tube is im-mersed, and which seeps in through the perforations Each of the 414-inch tubes in the grid contains about 350 of the tiny nickel disks and their alternating distance through which the current has to penetrate, in the charge and discharge of the cell, is only one-half the thickness

of the exceedingly thin layer of hydrate. The thin nickel flake is formed by an ingenious machine which deposits alternate electro-platings of copper and nickel, the copper being dissolved out subsequently So delicate are the nickel disks cut from this electro-plated sheet that a handful of them is as light as so much feathers.

The negative or iron-oxide plates, of the same length and width as the posttive plates, rows of eight flat, rectangular pockets, sch perforated like the tubes of the positive plate with fine holes to permit contact of the electrolyte with the active material. The latter consists of an iron oxide very similar to ordinary "iron rust," subjected to heavy pressure in the containing pockets, so that each mass of active material is practically integral with the grid

The plates of each group, negative, are hung on their horizontal connecting rods, with spacing bushings between the lugs of the plates and a nut at each end of the rod Rising from the middle of the rod is the vertical terminal post, having a taper top for making good electrical contact with the adjoining cell or with the external circuit.

The outer surfaces of the two end plates of the element are securely insulated from the walls of the can by sheets of perforated hard rubber. Rods and cross-pieces of the same material serve respectively to separate adjacent plates of the element and to support the lement as a whole above the bottom of the can It is noteworthy that the element does not have to be supported at a considerable distance above the bottom of the cell, as in the lead storage cell, to prevent short circuiting of the plates by the falling of the active material to the bottom of the jar. In the Edison cell there is little or no loss of active material

The remaining part of the cell, the top or cover of the can, is welded in place by the autogenous method after the element is assembled in the can. The terminal-post stuffing boxes, the gas vs which separates entrained electrolyte from the spraying of the gas in charge and prevents it from escaping, and the filling aperture with its automatic spring ising, the positive or nickel-hydrate accap, are water-tight, so as to prevent the minimal, commist of a grid of hickel-leakage of electrolyte in service. The tight size, holding 30 little tubes packed gas valve, by preventing loss of elec-

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vater during long periods in the life of the cell.

Connections between the cells of a battery and with the external circuit are made by means of heavy nickel-plated copper-wire connectors, with steel lugs swaged on the ends and fitting on the taper terminal posts.

The element is made very compact, with no provision for circulation of electrolyte because the latter is constant, chemically, electrically and physically. In this "can of electricity" the solution is a mere liquid carrier of lons—it has, so to speak, no moods and tenses of its own to be catered to by the battery user. Whereas in the lead cell the constitution (proportions of sold and water), conductivity and specific gravity all undergo definite definite change during the cycle of charge and discharge, in the Edison cell these qualities remain unaltered. On account of the low voltage of the cell, a vehicle battery of given voltage must contain a larger number of cells than a lead battery, twenty-four lead cells being quivalent to forty of the nickel-iron cells of same ampere-hour capacity; but the low voltage and comparatively high internal resistance are disadvantageous from the purely electrical rather than the vehicle point of view The cost of charging current, and hence also the ef-ficiency of its recovery in the discharge circuit, is a minor part of the total ex-pense of operating the vehicle; and the low electrical efficiency of the battery is low electrical efficiency of the battery is offset by its actremely light weight—which not only lightens the construction of the vshicle, but increases the proportion of "paying load" carried by the same—and by its ruggedness in service, in estimating the true commercial efficiency of a road-vehicle transportation, the tonmiles obtained must be compared with the total cost of operation of the vehicle, with due allowance for all-around recie, with due allowance for all-around re-liability. The nature of the support ma-terials and the method of applying the active material to the plates enable the cell to stand dead short circuits without it is stated that the cell iminjury. proves in use, instead of deteriorating, and the company guarantees to renew any battery at any time for half the cost

In charging, the rate can be varied through a wide range, and may be far higher than would be safe with the lead battery. "Boosting charges"—given a vehicle battery when partially dis-charged, so as to carry it through a longer period that its prescribed day's work—may be given for an hour's run at a rate two or three times the normal a rate two or three times the normal charging rate; and a regular charge may be completed in a burry by starting at a ligh rate, and gradually decreasing the rate. A vehicle, manufacturer using the battery raports that he charged an ea-bantesid bettery of Ac cells at the rate of 100 anispers for a during time, and states that it pays better to get in spec-

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. . .

instenths of the normal capacity in a rt charge at a high rate than to give long, slow charge traditionally ad advisable for lead cells. A comat vehicle bettery of high capacity freduct the heat manite with a 75 to He per pent charge at high rate every day, thereby avoiding the loss of ef-licities of charging that comes at the end of a "normal" charge at the preed rate. A battery showing about 100 volts when charged can be thrown directly on the 110-volt mains without resistance in series.

It is the discharge performance of the battery, of course, expressed in "miles in the battery," that the auto driver is most interested in. Hill climbing is a favorite test of an automobile plant, and the performance of the Edison battery in this respect is a good in-dication of its road ability. An electric pleasure vehicle equipped with the bat-tery, the total weight being 2,387 pounds, has climbed Fort George Hill, a distance of 2,138 feet with 11 per cen grade, twenty-one times on a single charge. Another interesting performance of the battery in city work, on a single 71/2-hour charge, is a "run-about" of an hour and a haif to two hours every day for seven days. The total weight of the car and two passengers was 2,470 pounds. and a total of 120 miles was made at an average speed of 12.32 miles per hour The cost of the charge was \$1.42, which es to about 21 cents per day.

The garage work other than charging is simplified by the absence of corrosive



Filling up an Edison cell for evaporation

fumes, the substitution of bolt-and-nuconnections for lead-burning, the good retention of the active material by the plates and the absence of "sulphating" and similar troubles, and the non-fragile nature of the cans and elements. It is claimed that a single garage man can readily take care of a very large number of batteries; and in fact the Edison battery is not regarded as very attractive business by the public garages ac-customed to doctoring lead cells which have been abused, or worn out, in vehicle service. The cells are filled with elec-trolyte and assembled in trays before leaving the factory, and the sealed top means that the element is not expected to be meddled with by the user, and reduces his work, practically, to m pervision of the charging and filling up pervision of the charging and filling up for evaporation, an external releasing about twice a year (taking the cells out of their trays and removing dirt from between and undermeath the case, and removing rust; if any), and putting in new electrolyte at long in-tervals. The cell is able to stand idle terrais. The cell is able to stand idle for long periods, wholly or partially dis-charged, without injury, because the non-corrosive material of its plates is immersed in the alkaline electrolyte, ctrochemically, in a e of stable equilibrium.

The element and its separators fill a urge propertion of the cubic contents The element and its separators fill a shape properties of the can, and the amount of electrolyte is small, sixting rise to a greater lead. set by means of the acrow to the book space of the can be a greater lead. set by means of the acrow to the book space of the can be considered by the card to correspond with

rent than in lead cells. Continuous worl ing at high temperatures has an injurithe cell, but a temperature of 100 degrees is not critical. In hot weather an electric fan may be turned on the be tery when charging, to keep down its temperature. The metal cans and the small amount of solution invite more rapid chilling in a vehicle standing idle in winter than the heat-insulating hard rubber jars of the lead battery, and is to be avoided by properly inclosing the bat tery trays, sealing up all holes or open-ings to avoid the entrance of the cold air. In charging, however, the battery compartment must be left wide open The small amount of electrolyte and the liability of heating on charge at the high charging rates which are permissible, give rise to another sensitive point in the handling of this type of cell, namely, "low electrolyto," i e, exposing the tops of the cells, and causing loss of storage capacity. In active service it is necessary to "fill up for evaporation" every few days, using distilled water only (ordinary water, which is more or less impure or which has been aerated by absorption of carbonic acid from exposure to the air, being injurious to the cell), and putting in the water just before giving a charge, to avoid the false level due to was hubbles in the electrolyte. Since the closed and sealed top of the cell prevents a view of its contents, a special filler is provided by means of which water may be added to the same height in a large number of cells in rapid suc-cession. This filler is connected by a flexible rubber tube to an overhead cov ered tank of distilled water, and is also wired to an electric bell and dry battery The filler spout is inserted in the apture of the cell, and a thumb-valve on the filler is operated to allow the water to flow into the can. The stream of distilled water presents a high resist-ance in the bell circuit, but when the level of the electrolyte has risen into contact with the end of the spout, th bell rings. It is important to avoid filling the cans too full, for this leaves no room for the gas to escape during charge and the electrolyte is liable to be forced out in bubbles—a cause of low electrolyte

The potash solution becomes contaminated in time, from impurities that have accidentally gotten into the cell eithe directly or by way of the filler spout (which may be laid down carelessly on a dirty bench), or by absorption of gases in the garage. It therefore needs to be replaced by fresh electrolyte about or in eight months for a commercial-vehicle battery or once a year for a pleasure vehicle battery.

Some Mechanical Road Guides

(Continued from page 33.)

road maps and guide books is that one must first know his precise location on the road before he can tell when and how to proceed; a mistake of even half then making a turn might throw one entirely off the course and cause much trouble.

One card screes for only one route, and if this route is more than 100 miles ong but less than 200 miles, the card is reversed and the directions on the back are followed. The manufacturers of the are followed. The manufacturers of the instrument supply cards covering all known touring routes in the United States, including several transcontinental routes, and also principal touring can routes, and also principal touring routes in Europe. About 600 routes are catalogued for this country alone. The cards can be ordered by number as wanted, and kept in good order in a card-board case furnished by the manufac-

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the point where the main read is plaked gain. To facilitate driving at atght the face of the instrument is illuminated by a miniature electric light attached by by a miniature section in the case so that it will throw its light on the pointer and card beneath, but cannot shine into the driver's eyes.

The "Live Map" can be attached by a strong bracket to the steering column, or may be secured to the dash or hung in a leather case on the coat rail in

THE CYLINDER CHART.

It is very interesting to observe how a similar result is obtained in an en-tirely different way in the "Pathfinder" instrument produced by another ininstrument produced by another in-ventor. This is in the form of a brass cylinder 8 inches long which has at-tached to it a strong steel clamp by which it is secured to the steering col-umn directly under the steering wheel. On the upper side of the case is a long, narrow slot protected by a strip of glass. Within the case is a long-collection culticate. Within the case is a telescoping cylinder. the outer or larger tube of which is arranged to be revolved axially by a flexi ble shaft driven by the front road wheel of the car. On this cylinder is a train of forty mileage bands and the same num-ber of direction bands, all of metal and alternating alternating Each mileage band repre-sents five miles of travel, and its edge is divided into miles and tenths of miles, plainly indicated Each direction band, which is of smaller diameter than the mileage bands, is marked on its edge with letters or characters indicating when to proceed straight ahead, when to turn right or left, which fork to take, and so on. These bands serve for any and all routes, being reset by the user for each successive route to be traveled, as will be explained later
Inside the case is a "finder" carrying

a pointer. The finder is caused mechan-ically to travel as the car advances, from the left to the right end of the slot in the case, moving successively from one pair of mileage and direction bands to the next. At the approach to each turn in the route, the instrument makes an audible signal, and the little red pointer on the finder points to letters on the di rection band, giving the next direction to be followed, while marks on the finder coincide with divisions on the mileas band to the right of the direction band showing the exact distance to the next turn Thus, the driver cannot inattenreminded of it before reaching the turn ing place

A small electric light is attached to the instrument to light the dial at night, and there is a little clutch within the case operated by a thumb-screw outside, by which the mechanism can be thrown out of operation when making a side trip to permit the cylinder to be turned at will when resetting the instrument. The total of the mileage bands represents a distance of 200 miles, and, according to the number of turns in it, a route of from 50 to 180 miles can be indicated

with one setting of the bands. To reset the instrument for any given route before starting on it, the case is opened and the cylinder removed. The belowed and the cylinder removed. The telescoping part is frawn out and the bands all slipped off upon it from the larger portion. They are then reassembled on the outer tube of the cylinder with the marks on each in a certain relation to the others according to a ro key that is furnished by the manufac-turers of the instrument. This can be done very easily and quickly, but it is hardly necessary to go into an explana-tion of the precise process here. When the whole route has been transferred to the whole route has been transferred to the cylinder in this way the cylinder is replaced in the case and locked by a thumb-screw at the end. The finder and pointer are slid back to the satirame left. pointer are stid back to the saxrams may of the dial and the cylinder is previously until the line on the finder is dressing in line with the first mark or elacting the first way point on the cylinder. The distributes in the cylinder of the cylinder of the cylinder of the cylinder.

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Inquiry No. 8805. Wanted, the address of the manufacturer of the "Little Glant" Pump.

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Places mention the Scientific American when writing to ally the of signature and the car has dene in the most efficient manner by drives to the starting point of the

e are furnished for more than principal touring routes in the official A. A. A. route books.

BRATED ROUTE INDICATOR.

Whereas the two instruments described ed automatically by a flexib shaft, a third device is operated by the fingers of the driver's right hand. the fingers of the driver's right hand.
All the mechanism is contained in a cylindrical case 6 inches long and 3 inches in diameter, made entirely of brass and aluminium and moisture proof.

This case is riveted to a stout metal bracket intended to be clamped to the steering column just below the steering wheel where it will be directly under the driver's eyes and within reach of the ers without removing the hand from the wheel. The mechanism consists of two brass reels turned by gears that are controlled by the small wheel at the right hand end of the case. On the reels is wound a strip or sheet of specially prepared paper upon which are printed all the road directions and distances for a given route, and as the route is traversed the paper is unwound from one feel upon the other, much as a roll of films is used in a kodak.

In the upper side of the case is a large glass covered opening through which the directions on the strip can be read. single strip is long enough to contain all the directions for a route of 250 miles (that most traveled route in America, from New York to Boston, 244 miles, be ing on one sheet). Yet each direction is printed in a separate paragraph in plain type and with arrows indicating the diction and angle of turn to be made. paragraphs are spaced well apart and the words well separated. An important feature of the instructions is that each one carries the traveler beyond a turn onto a straight stretch be-fore giving a new direction, whereas the guide books take him to a point and then give new directions, which is sometimes confusing. Distances from the starting vided into compartments to accommo-point are given in all paragraphs in date the pieces of various sizes. Differmiles and tenths of a mile, and prominent

The reels and paper strip are easily revable, and can be withdrawn from the right hand end of the cylinder with the erating wheel A fresh strip bearing directions for another route or a continuation of the same one can be sub-stituted quickly for the used stripwhich can, of course, be used again at any time. Attached to the removable mechanism is a small dry battery and : 214-candle-power electric light When darkness falls, the moving of a switch on the outside of the case turns on the light which glows behind the translucent paper and brings the printing out in

Because this guide is not driven from recause using guide is not driven from the road wheel, it is necessary to use an adometer in connection with it to show the distances traveled by the car in order that the directions can be followed at the right places on the road.

Prices for the several mechanical road guides described are \$75, \$60, and \$35, respectively, and extra youte cards or strips are 25 couts each. With every instrument hought is given a set of directions for a number of tours. In one case the sat comprises tweive cards, in antion of routes covering 3,00 other a seaction of rottes covering Jove miles in day section of Adiguta, and in a thru case the purchases in given a volume of key routes covering from 20. odd to 76,900 miles.

hand. This same machine can be a for reaming out the valve-pockets of four cylinders at once by substituting reamers in the chucks for the flat-ended tools that fit in the valve glots

All of the machines and tools so far described are for the rapid manufacture of parts in quantities, but in order to obtain the greatest efficiency from a plant, these machines must be supple mented by a system that provides for the equally rapid disposal of the parts so completed. In other words, the product of the machines must not be allowed to accumulate to such an extent that the tools will be forced to remain idle for any appreciable length of time. In an automobile plant, the only way to dispose of these pieces as they are manufactured is to assemble them into the various parts that go to make up the completed motor car, and this means an assembling system and organization as perfect and efficient as that required in the machine shop proper. Such a system has been carried to so high a state of efficiency in one of the large factories that 35 cars have been completely assembled in one day by a force of men-and that is quick work considering the fact that these cars grew in a single day from the bins in which the smallest parts are kept to the completed machine, ready to rare around the testing track.

TEAMWORK THE KEYNOTE OF SUCCESS

The keynote to this wonderful system is "teamwork," and by so grouping the men that three can work on two cars at once, each knows exactly what he has to do and is able to keep out of the way of the others Each team of three men continues to work on the two cars until both are entirely completed, and they then devote their energies to the next None of the men needs to step more than three paces from the frames that form the nucleus on which each can is erected, for the proper number of parts for the two muchines are supplied by the stock-room attendants, who wheel them in as required in small trucks diential pulleys that run on an overhead track passing in front of each frame allow heavy parts, such as motors, rear axies, and transmissions, to be set in place easily, and as all parts are practically interchangeable when they leave the machine shop, but very little fitting is required. This is in striking contrast to the old days of the "built-up" cars when each part had to receive individual attention and to be fitted to its own special place. In the early days of automobiling there were almost as many types and varieties of chassis and bodies as there were users of the cars. One shop might turn out a dozen varieties of chassis, each interchangeable with as many more different kinds of bodies. and the result was that no maker's product could be termed strictly uni-The production of parts by maform chine tools, however, has brought about a striking change, and to-day we find the majority of manufacturers confining themselves to two, or at the most, three sizes of chassis. In some instances the entire plant is devoted to the manufac-ture of but a single type of chassis, and when this is done, each workman and every machine can concentrate their efforts on the parts of this one product.

Body building is generally considered to be alightly distinct from automobile manufacturing, and although many plants have departments in which this work is done, it is usually classed as carriage maker's art. This fact, how-ever, enables factories that make but one Type of channels to give their customers type of channels to give their customers the choice of several styles of bodies, and in consequence the ordinary observer might consider that this plant was taken to be considered to be



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Following is a list of the chapters:

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3 18(5, 1817, 1818, 1819, 1820, 1821

3 18(2) The Practice and Theory

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¶ 1713. The Wright Aeroplane. This is a thorough description of the old type of Wright biplane with the horson-tal elevation rudder in the front of the machine. Excellent diagrams and photo-graphic rows accompany the paper.

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Indications now point to the fact than in the near future, the manufacture of pleasure cars will be confined to two classes of plants—those for the construction of high-powered cars, and the other devoting their energies to the product of the light, low priced machine. But in addition there are the encouraging present and the tremendous future possibili-ties open to the commercial car, and it is probable that the same distinctions as those mentioned above will be made in regard to the manufacture of this class of motor vehicles. As machines and tools are introduced that are capable of performing the most efficient work on parts of a certain design or size, the variety of styles and models of cars that can be constructed economically may be said to decrease with the increase of duplicate parts production.

The Motor Truck vs. the Horse.

(Continued from page 37.)
Miller gasoline truck in the 3,000 to 6,000 pounds' capacity class won first prizes in the manufacturers' and private owners' divisions with a record of a ton-mile cost for gasoline and lubricating oil of only \$0 00765, or slightly more than % of a cent. An Autocar gasoline delivery wagon owned by Wanamaker's department store, was given first prize in the class for 3,000 pounds or less, with an expense for the items named of \$0 00898 And a Franklin gasoline air-cooled truck in the manufacturers' division for the same weight class, won first prize with a cost of \$0.01285 per ton-mile. A General Vehicle electric truck took first prize in the 3,000 to 6,000 pounds class with an operating cost of \$0.007, or 7/10 of a cent per ton mile, and another truck of the same make won first prize in the 3,000 pounds or less class with a current consumption and lubricating oil cost of 1 cent a ton-mile.

The Boston contest, October 21st and 22nd, was to Newburyport and return, through Lowell, Lawrence, Haverhill, Salem, and Lynn, a total distance of 1187 miles There were 37 participating machines, of which 32 finished, 24 of them with clean road scores—that is, having maintained the schedule within half a minute. All were gasoline ma-chines Prize winners were as follows: Warren-Detroit, 1,000 pounds or less, ton-mile running cost, \$0.0248; Autocar, 1,000 Franklin, same weight class, ton-mile cost, \$0.008; Frayer-Miller (Kelly), 6,000 to 8,000 pounds, ton-mile cost, \$0.0091

In the New York contest, October 28th to 29th, there were 49 contestants, of which number 26 were gasoline and 23 electric More than half made perfect road scores and only 6 had any mechanical trouble The big gasoline trucks in the transfer division were required to cover 65 miles each day, while the ga line and electric delivery wagons had to cover only 30 or 45 miles, according to classification. A special prise was given an Autocar delivery wagon owned by Wanamaker, which made a record of a total operating cost of only 1 cent a mile per ton carried. A Kelly (Frayer-Miller) gas truck in the 3,000 to 5,000 pounds class showed an operating cost of \$0.0086 and a Sampson gas truck in the 5.000 to 6,000 pounds class carried its full load at a cost of \$0.0088. A General Vehicle elec-tric truck carried 5 tons throughout the wo-days' trial over city and suburban streets at 4/10 of a cent per ton-mile.

In the Chicago trials held the same week, raw, windy weather prevented securing accurate operating cost data by blowing away the confetti that marked

tons. All were loaded to full catalogue capacity. Only gasoline ours competed, and of these 45 reached Miwaukee on schedule time and 40 got back to Chicago within the time allotment. There were 13 perfect road scores. A Brush packs delivery wagon carrying 536 pounds, and a Gramm truck carrying 6,200 pounds both made clean road scores and passed the technical examination at the end of tne test without a single demerit. The distance covered was 108 miles the first day and 104 miles the second day

The foregoing contests serve not only to show the interest taken in this sub ject, but also how the vehicles can be depended upon to get there and back over considerable distances on city and coun-try roads and about what the running cost is for fuel or current consumption and lubricating oil or grease.

Another notable indication of interest

and activity is the plan for the national automobile shows this winter. In New York at Madison Square Garden, in Chi-cago at the Coliseum, and in Philadelphia the shows will continue for two weeks, the second week in each city being devoted to an exhibition of comcial motor vehicles. The biggest and most representative display of these mamost representative display of these matchines will be the one in Chicago, at which forty-aix manufacturing concerns or selling agencies will make displays during the week from February 6th to 11th. The second largest will be in New York at Madlons Guaise Garden, January 16th to 21st, at which there will be adventured to the control of the control o 34 exhibitors of commercial vehicles. The exhibition in New York at Grand Central Palace, December 31st to January 7th, allotted space to one-half as many commercial vehicle makers as to pleasure

It would require volumes to tell of the at would require volumes to con-excellent work that is being done by motor wagons in almost an endless variety of businesses. They are giving satisfaction in many parts of the country in express service, both in the city and between cities; and in the wholesale and retail grocery, meat, drug, beer, min eral water, bakery, produce, drygoods furniture, piano, clothing, coal, hardware lumber, and many other trades. All that can be done in the limited space here can be uone in the limited space here available for the subject is to give a few concrete examples that show the en-durance, capability, and economy of the machines.

A recent evidence of the endurance of the motor truck is furnished by a trip made in October from Detroit to New York by a one-ton Grabowsky truck.

The vehicle carried considerably more than its full rated load capacity and three men rode in it all the way. The route was through Canada from Detroit to Niagara Falls, thence to Buffalo, Ro chester, and down the Mohawk and Hud son River valleys to the metrop total distance of nearly 1,000 miles as given by automobile route books. The trip was made on 99 gallons of gasoline, 19 pints of lubricating oil, and 7 pounds The running time was 53 bours, 5 minutes, or an average rate of more than 18 miles an hour. It is said that no repairs were made during the trip, and the only replacement was a spark plug. Following this run, the same machine took part in the commercial vehicle contest in New York, covering 45 miles on two successive days, with 100 enforced stops each day, and finishing with a perfect score each day.

An example of the ability of a motor truck to do work that could not be done at all with horses is furnished by an emergency shipment of motorcycles from Springfield, Mass., to New York during the recent express strike for shipment by steamer to England, where the motorcycles were to be exhibited in the London autom bile show. Lack of tim nowans away the content that marked London sutomobile show. Lact'rd time the route to Miwaukee shad back, so that prevented shipping by freight, so the some of the drivers lost the road, one twelve machines were loaded on a Kang' driving as much as forty miles earther motor truck and left the heatey at "\$ tann the length of the course. However, o'clock P. M. on October 19th. An and there were 5 to contenting vehicles, range, "after then from 11 P. M. 50 7 A. M. 1911 fing in capacity from 900 pounds 40 5 mande in Hartford, and on the special day

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the truck reached New York city at 5 more present reseased New York city at 5. P. E. The distance covered was about 150 miles, said the average rate of travel was 15 miles an hour. The only delay was maused by the sinking of a wheel was naused by the sinking of a wheel in such sand at Windsor, Conn., requiring

a jack to extricate it.

Again, during the military maneuvers at Chickamauga from June 27th to July Slat last year, a White gasoline truck of 1½ tons' capacity carried supplies and ammunition from Chattanoga to Chick-amauga, eleven miles. Much of the time it rained, yet the machine averaged practically 60 miles a day, moving an average of 8,798 pounds daily. The total mileage for the period of slightly more than one month was 1,826 miles, and the aggregate amount of freight moved, 281,453 pounds The total cost of the operation was \$107.29, covering 210 gallons of gasoline, 27 gallons of oil, tire repairs and de-preciation, and miscellaneous items. Based on the performance of this one truck, all the freight that could be move by the 46 horse and mule teams (15 of them double teams) could be moved by four 1/2-ton trucks and six 3-ton trucks. The cost of the operation would be less than half, and the number of men reguired only one-quarter.

Average results obtained with a num ber of vehicles in the hands of different owners engaged in various trades and extending over considerable periods give the best basis for arriving at what can be expected by other users. Actual cost records of twenty Chase motor wagons of 500, 1,000 and 1,500 pounds' capacity, as used in Syracuse by us many different lines of business for periods of 6 to 22 months, show an average cost per month tires and batteries, but including repairs due to carelessness and accidents, of \$18.25 per month per car. An estimate of the cost per year of running and maintaining one of these wagons, which covers 50 miles a day with a consumption of one gallon of fuel to every 14 miles, is \$1.217, figuring depreciation at 20 per cent, re pairs at \$150, and tires at \$50 As comparcd with this the maintenance of two one-horse wagons, at a total estimated cost of \$22 a week, would amount to \$2,112. The resultant saving by the employment of the motor vehicle amounts to \$895-almost enough to pay for the machine the first year.

A dry goods firm in the hilly city of A dry goods firm in the hilly city of Allentown, Pa, furnishes the following comparative statement of the cost of using an International auto wagon of 800 pounds capacity, fitted with high wheels and narrow solid tires, for one month, and of doing the same work with

Driver's wages	\$60.00
Boy's wages	24.00
Gasoline, at 14% cents	27.69
Oil	7.31
Repairs	9.45

HOUSE WAGONS. Wages for two drivers... \$104.00 Wages for two boys..... . 32.00 es. 35.00

Saved in one month.. \$42:55

\$171.00

The foregoing showing is the more remarkable because while repairs to the more wagon are included, no item 50-paras for repairs to the constant repairs to the foregoing. The same firm that the average cost per month for the motor wagon for fissel, ell, rent, and repairs is 20 as egainst 480 for feet, shoeing, and repairs is 10 as egainst 480 for feet, shoeing, and repairs is 10 as egainst 480 for feet, shoeing, and repairs is 10 as egainst 480 for feet, shoeing, and repairs is 10 as egainst 480 for feet, rent, shoeing, and repairs for a contract of the contraction of the motor freed, rent, shoeing, and repairs for the raters and scagging of the roof feet, rent, shoeing, and repairs for a contraction of the motor freed, rent, shoeing, and repairs for the contraction of the feet of o

the wages of one or two drivers often of helpers' wages as well, and that the space required for storage is not only reduced this much, but that each mot wagon requires only from one-half to two-thirds the actual space needed for one wagon and one horse and no space is necessary for the storage of bulky hay and feed.

Motor trucks and wagons are built for

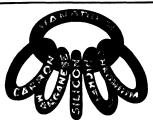
almost every conceivable purpose for which horses and wagons are used, even for work in farm fields, for road building, hauling milk, ice, household goods, for street sweeping and sprinkling, and many other special purposes. In design and construction they vary as widely as pleasure cars ever did, and in carrying capacity range from the 100 pounds or more that can be carried in parcel de-livery tricycles to 7 and 10 tons moved by massive trucks. Speaking very broad ly, there may be said to be two standard forms of construction; for the better trucks of 2 and 3 tons and upward, the use of a vertical four-cylinder motor in front, sliding gear transmission, differential countershaft and side chain drive, and for delivery wagons and light trucks of one and 1½ tons capacity, doublecylinder opposed horizontal motors placed either in front under a hood crosswise of the frame, or under the body of the vehicle lengthwise of the chassis When the horizontal motor is used plane tary transmission is frequently employed, with single chain drive to the counter-shaft, though in some makes sliding gears and shaft drive are employed Water-cooled and air-cooled and fourcycle and two-cycle motors are used in different makes, each having its advo-

The Small Inexpensive Garage

(Continued from page 42.) mentioned that a plain frame garage 12 by 18 feet, with hip roof covered with codar shingles, finished outside in stucco and plastered and whitewashed inside, cost the purchaser \$200 when bought with a new house. The cost to the buildthis amount.

METHODS OF CONSTRUCTION.

Different manufacturing companies have different methods of construction, but the underlying idea in all so-called portable garages is that they are ready made and assembled in sections so that they can be easily and quickly put together out measuring, cutting, joining, and nati-ing, as in the ordinary building. To take a typical example, one company makes all of its portable buildings me uring up to 11 by 15 feet with each side and end wall in one section and each side of the roof in one section. Any one of these pieces can be handled by two men. This method reduces the joints two men. This method reduces the joint to the least possible number and results in a strong, tight, and weatherproof building. Frames for the wall sections are of 2-inch cypress, with studding placed 14 inches center to center. The places is increased from the center. The corner joints are drawn firmly together with 8-inch lag screws. A special weather-proof lining is stretched over the frame of this is nailed cypress red cedar siding. Roof sections are made red occar siding. Roof sections are made in a similar way, and where they meet at the ridge they are capped with a 3 by 3-inch ridge pole milled out to fit closely over the ridge boards. The raft-



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and swing in or out. Special ventilators carry off the fumes and odor of gasoline. Every garage is painted according to specifications of the buyer, with sev-eral coats of good paint. If desired, a pit will be cut in the floor, and on order the garage will be furnished at extra cost with a tool chest, robe rack, and chauffeur's room

These garages are supplied in several styles, with either gable or hip roof, Sizes range from 9 by 12 feet to 18 by 40 feet, and prices run from \$135 to \$825. Every garage is guaranteed for ten years. Two or three men with no knowledge whatever of carpentering can put up one

framed and ready for erection, which costs approximately \$25 for carpenter hire Each piece of lumber is cut to emplate in the factory and numbered to correspond to numbers shown on the erection plans sent with the material This material is bundled together and shipped and can be put together by an ordinary carpenter without any difficulty. One priming coat of paint is applied to

Hardwood posts 3 feet 6 inches long ire furnished to be set in the ground at each point of support for the en trance and girders. There are two lines of girders under the floor to give sup-port directly under the car Girders, frames, and sills are of large size and the side walls and roof framing are sul stantial and well braced throughout All exposed framing is dressed and of select quality of the kind best suited to the particular purpose for which it is used Wood specially adapted to resist moist ure is used for the floor, so that it will dry off quickly after washing the car Matched siding is put on vertically. The material supplied for the roof consists of ards to be laid on tight and 16-inch cedar shingles to go on over the sheathing. Any desired style, shape, brand, or arrangement of slate, tin, or composition can be applied, however, suit any requirement or style of architecture of the residence

There are six glazed windows, ranged for the best distribution of light for examination of the car and making repairs. They are set in adjusted slide to that they will not rattle and are fitted with strong locks Besides the pair of entrance doors, which are braced against sagging and provided with heavy hinges saging and provided with neavy images, strong boits and chains, there is a side door near the rear end of the garage, where the workbench is placed. This bench is of good size and has a solid plank top A commodious tool and sup-ply or parts cabinet is also provided, to be secured against the wall

Every exposed piece of this garage is given a priming coat of paint before shipment, which makes a good founda tion for a subsequent coat of any color the owner may wish. The garage is made in only one size—14 by 20 feet outside measurement—and is delivered completely framed, literally ready to set up, so that about all the work that is uired is merely to assemble the large built-up sections and drive a few nails

PIREPROOF GARAGES OF METAL

Fireproof metal garages as furnished by two or three companies have undeni-able advantages for use in downtown sections of cities where building regulations prevent the erection of wooden struc tures, and in other locations where the proximity of a wooden garage to frame proximity of a wooden garage to frame dwellings would create a five hazard and increase insurance rates. Lefte some of the sectional frame portable garages, the metal ones are made on the interchange-able unit plan. Side and end wills are made in 2-foot wide vertical sections and

the roof in sin eavy galvanised steel, the sit embossed and the roof section imitation of tiling. No framing wi The construction is unique and this is believed to be the first strictly firepr portable garage ever put in the market By ingenious architectural and struc tural methods, the siding, roofing, ride gables, cornices, sills and tie rods are made to interlock and support one another All material is shipped in unit sections with patent interlocking edge ready for immediate erection. One o whatever of curposate of the garages easily by following the of the garages easily by following the directions that come with them, as all size of the structure. A common size is sections are marked plainly to correspond to the plans. The only tools inheed in 10, 14, 16 and 18 foot widths needed are a wrench, a hammer, and a land in any desired length in multiples. two days suffices for the complete erec screwdriver
Another type of ready-made garage is 12 feet high. For motor trucks, side furnished "knockdown." completely walls may be 12 feet high and entrance doors 11 feet 9 inches in the opening. Bent galvanised steel anchors provid

a foundation that carries angle-iron sills to which the wall panels are attach Windows and doors have galvanized metal frames. Windows may be inserted in every other panel two feet from any corner and a single door can be inserted in any unit two feet from a corner. Thus the purchaser can vary the size and arrangement within rather broad limits No floor is furnished except on order and at extra cost, as the floor can be laid in cement, cinders, cement blocks, bricks, or wood, all more cheaply obtainable at lestination than if shipped with the garage.

Inasmuch as the material is all galvan-ized, painting is not essential, but many owners have painted and sanded the sid walls to represent stone and painted the roof a duli green to give the impression of a solid stone building with a tile roof. Prices of these metal garages range from \$124 for a structure 10 by 14 feet to \$236 for one 16 by 24 feet, and the weights range from 1,860 pounds to 3,540 shrung

Anoth r type of fireproof steel portable garage has a wood foundation which, however, is embedded in a floor to be laid in concrete, eement, cinders, or as-phalt All of the rest of the construction is metal The uprights are of iron pipe, the framing of angle-iron, connecte malicable casting and suitably braced, the rafters of T-iron and the roofing of galvanized steel. Sides, ends and doors are also of galvanized corrugated steel. The gables are lighted by small windows hinged at the top to swing in and oper-ated by cords. These garages are made in both gable and flat roof styles, those with flat roofs selling for lower price than the others.

A combination of wood and iron or A combination or wood and non-steel is employed in some portable garage constructions. One make has founds tions of wood, with wall and roof fram ing of iron pipe and angle iron. The floor is 2-inch hemlock planks, the side and end walls double beaded matched vellow pine and the roof corrugated from given two coats of paint inside and out. Prices vary from \$95 for a 9 by 12 foot to \$215 for a 16 by 20 foot garage of this construction.

When considering the purchase of a garage there is danger of figuring too close and making the mistake of getting one that will be found too small. The user may not expect to do much work on the car inside the garage and may plan to do the washing outside, but in winter there will be many times when he will want to tinker with the and when the washing cannot be do in the open. During other periods of a year there will be rainy and windy do year there will be rainy and winds, mays when the shelter of the garage will be most welcome while small regards adjustments are being made. At all stack times cramped working quarters become an absumation. These which is the least two feet and profession because













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of working space all around the car, wood. By the use of these columns, and with axtra room for the work bench and, by extending the platforms and baltool cabinet. The bench is most con-conies, 26,000 square feet of exhibition veniently located at the rear end of the space was gained for the show. Over garage, directly in front of a window ▲ building 10 by 14 or 9 by 15 is barely large enough to allow space to work the smallest runsbout, and for a small touring car nothing smaller than 12 by 16 feet is to be recommended— 12 by 16 feet is to be recommended-12 by 18 or 20 feet is much better.

In this connection it is well to bear in mind that length is more desirable than width, because in the event of getting a new and larger car, the machine is very likely to be longer, but little if any wider than the old one, unless of course a touring our replaces a runsbout. In of a runabout, the experienced automobilist would recommend getting a garage in the first place that would b large enough to accommodate a small medium-sized touring car, well know ing that nearly all owners of small runmachines of larger capacity and power

Decorating Madison Square Garden for the National Automobile Show

In the procession of vastly varied vents which holds forth in New York's biggest show building, none has yet sucreeded in effecting more complete transformations of the interior of Madison Square Garden than the annual automobile shows. While the task of acrom-plishing this in a new way becomes more difficult each year, the genius of the show managers seem to rise to the occasion. For the forthcoming affair, which for the first time in the history of the Garden shows is to be an exn lasting two weeks, from January 7th to 21st, a new precedent for decorative schemes has been worked out. It is said that nowhere in Europe or America has there ever been attempted anything like such an elaborate and artistic creation for an automobile show When it is said that more than \$45,-

000 was expended in preparing the set-turer have to contend against is the de ting for the exhibits, only a vague idea struction of wood by insects is conveyed of what is presented. The It has been determined by selentists motor cars of America's representative that insects of a certain class attack the makers attract their usual following of wood and bark of living trees, and while

up the setting for the exhibits. A Ro- depreciation in commercial value sometectural design constitutes the decora-tive theme, and serves as a background for the exhibits. There is nothing tected until after the trees have been cut tawdry or cheap in the decorations, and and the logs carried to the mill and have there is much less ornamentation than been converted into lumber, and it is heretofore, with a consequent gain of not until after the expense of logging spacious effect and out-of-door feeling, and manufacture of the defective wood White and gold are the dominant colors has been ascertained, that it is known in the scheme, although green and crimson are strongly in evidence. The girders of the big dome are screened by a canopy of soft material, rich azure blue in tone, amid which myriad incan- and many others, but those mentioned descent lamps twinkle. Several massiv iamps of rustic construction will be pendant from the roof.

The exhibition spaces of the main floor and elevated platform are covered with ling as it does through the wounded bark a carpet of light green hue which adds of the oak, or through the bunded bark to the out-of-dore effect. At brief intervals along the sisten of the exhibits the covered with the covered barbon of the carbibits. of the arena and elevated platforms are ornamental lampposts, finished in bronze, which inform the visitors of the mes of the exhibitors and direct them to the variets departments of the show.
Along both sides of the areas are richly decorated boxes, which seat about 1,200 people. Extending around all the outer edge of the exhibiting space under the elevated platform, and towering up ward to the dome, a series of classic wart to the double, a series of channel columns lend much to the stateliness of the effect. These are of structural steel, but are no cleverly disguissed by lattice seek that they appear made of ornate

two hundred tons of steel and one million feet of lumber were used in reconstructing the Garden interior. Two monster freight elevators were inmonster freight elevators were in-stalled to hoist the cars to the galleries. These too escape the notice of the visi-tor to the show by their ingenious concealment behind latticed effects of each alternating column is an arbor, in the center of which is the emblem the show-a wheel surmounted an American eagle

There are six staircases leading to the elevated platform Two of these, in the rear of the interior, can be moved to allow exhibitors to be carried to the elevators

In the general view there are three balconies in the rear and in the front of the interior, and but two on either side. The foyer of the Garden is decorthat nearly all owners of small runside. The foyer of the Garden is decor-ults sconer or later replace them with side. The foyer of the Garden is decorunder a big Italian pergola. The walls are harmoniously decorated with posters similar to those used to advertise various automobile sporting events held during the past year.

Nothing more novel has been introduced in decorations than the rustic arbor that hoods the Concert Hall woodwork of the arbor is Adirondack stiver birch The counters. rafters, and lamps are all of rustic con struction. Another novel feature is found in the Exhibition Hall, which is transformed into a Roman garden Here the exhibits appear under a big pergola, twenty feet wide, extending all about the room The pergola is sup-ported by twenty-five Doric columns and decorated with ornamental foliage From behind a balustrade the visitor can feast his eyes on a gigantic paintwalls of the room

Our Insect-Ridden Timber Probably one of the greatest troubles that the lumberman and the manufac

makers attract their usual following of wood and cark of living trees, and while the public, but apart from them the they do not contribute materially to the scenic surrounding is worth a long trip, death of the trees, they produce wounds Big gardens and little gardens, serial in the bark and wormholes and pinhole gardens and underground gardens, make defects in the wood, which result in a man terraced garden of dignified archi- times amounting to from five to fifty per

that much of it must be discarded

According to the scientists, there are several worms, beetles, borers, and wee vils that are responsible for this damage ps the better known

The oak timber worm, as its name implies, is probably one of the most de-structive of the class just named Enter tends its "pinhole" burrows in all direc-tions through solid heart wood

Chestnut timber does not escape, for the chestnut timber worm damages in a like manner all chestnut trees and it is well known that practically every tree of marketable size is more or less affected. and in some cases, such a large per-centage is so greatly damaged that the product is reduced to the lowest grade. This insect does not confine its operations to chestnuts alone, but attacks and especially the red oak, which they

damage as they do the chestnut.

One of the commonest defects in white oak, rock oak, beech, whitewood, or yel-



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fully which, with this cities and it is immensed to CONNELL GARAGES are Sectional both or Sectional Units. The actions are as used that they controlled the controlled to the

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low poplar, elm, and many other tree is that known to the lumber trade as "grease spots," "patch worm," and "black This is caused by the timber or ambrosia beetles, which make attacks or the living sapwood from the time the trees are twenty years old until the reach the maximum age. In this way scattered all through the wood. This defect is also often found in oak and olm furniture and in hardwood finishes in dwellings and other buildings.

Turnentine beetles and borers appear to make a specialty of attacking certain species of pine, the red turpenting operating in the North and the black beetle in the South They generally attack trees with healthy bark, and often kill areas varying in size from one to ten square feet. These spots are subse-quently burned off by surface fires, and are then usually referred to as fire

White pine trees are also the object of severe attacks by the white pine weevil, and often the value of such trees is reduced from twenty to fifty per cent bethose of normal development.

Carpenter worms seem to affect the white and red oak, so much so that holes made by these insects are often over an inch in diameter one way by three-quarers of an inch the other, causing serious damage to the wood

of the most profitable trees in the natural forest or on artificial plantations, and one which would contribute largely to an increased timber supply, is the locust; but owing to the ravages made upon it by the locust borer, in many localities the trees are rendered hless for commercial purposes.

As stated before, there are many other examples of insects which damage the wood and bark of living trees, but those mentioned are sufficient to demonstrate

Employees

resulting from inventions useful to and used by the government, has always been a matter of interest to inventors gener-As a matter of fact, the relation of employer and employee in its bear ing upon ownership of patents issued to the employee is frequently a very perplexing one In a report to Congress by the Department of Commerce and Labor, the then Secretary, Mr. Straus, said. "There be no question as to the wisdom of so treating the employee inventor that he will not be placed in a more unfavor-able position with regard to his invention than is the case in private life; in fact, it would seem to be in the best interest of the government, from a purely selfish point of view, to place the emrespect to valuable inventions and discoveries which he may conceive

The same report from which the above quotation is made, referring to 253 ute patents which had been granted to of-States for inventions used by the gov' amoeclum or "slipper animalcule," as it is sometimes called The most curious proximately 141 have brought no net reproximately 141 have brought no net re- feature in connection with time norm of turns to the inventor, approximately 78 life is the extraordinary rapidity with have brought returns to the inventor, which it multiplies. By a wise provision have brought returns to the inventor, which it housepies. 9 and as to the remaining cases, it was of Nature these little creatures soon eximpossible to determine definitely haust their power, generally dying after whether there had been any remunera the government have expressly dedicated their patents to the public, while others luck and the members thereof live to attheir patents to the purple, while values place and the neamers there are the have dedicated to the government of the United States the rights to make and we are assured that they would crowd use the invention. In some other cases, every other living thing from the face of large returns.

Ointment for Burns (Lanolin Ointment). 100 parts lemon grass oil, 100 nolin, 15 parts sugar of lead, 2 parts liquid carbolic acid.

A Lottery for Filchner.—The govern-ment of Bavaria has undertaken to raise by means of a lottery, the 600,000 marks still needed to defray the expenses of Lieut. Filchner's south polar expedition. An equal amount has already been raised by popular subscription.

A New Star. -- We are informed by Prof. Pickering, of Harvard College Observa-tory, that a new star of the eighth magni tude has been discovered by Rev. T. E. Espin, of Walsingham, England. The star will be known as Nova Lacerta It was observed visually and photographically

Insurance Against Hail, -The Canadian Province of Alberta continues its popular plan of insuring crops against hail The latest annual report of the Territorial Department of Agriculture shows that in the year 1909, 246,699 acres of farming land were fully covered by this form of insurance, and 48,732 acres were partially insured. The rate varies from 20 to 40 cents an acre. The total premiums collected, amounted to \$84,869, and the total indemnities paid, to \$152,080

A Strange Heat Wave, -A curious heat wave is reported to have passed over Santa Cruz de Teneriffe, Canary Islands during the night of November 3rd and 4th At 12:45 A. M the thermometer at th municipal meteorological observatory registered 63 deg F.; it then suddenly rose within two minutes to 79 deg F., and after remaining at the latter temperature for a few minutes fell back suddenly to 63 deg F During this time the baro-graph showed marked oscillations of pressure No satisfactory explanation of this occurrence has been offered

A New Aerological Observatory. — It is reported that an aerological observatory will be erected next spring on the Iselberg (altitude 916 meters) by the importance of insects in this relation, direction of the Duke of Saxe-Coburg-Gotha The task of installing this sta-Patents and the Government tion has been intrusted to the Lindenberg Observatory It is also expected that an aerological station will shortly The pecuniary benefit to officers and be opened on the Feldberg, in the Taunus employees of the general government, Mountains, Prussia These will be im-Mountains, Prussia These will be im-portant additions to the German network of stations for upper air research many is already far better provided for in this respect than any other country.

Bjerknes on Dynamic Meteorology. -The Carnegle Institution has just pub lished "Dynamic Meteorology and Hydro-graphy," by V. Bjerknes, of the Uni-versity of Christiania Prof. Bjerknes is one of the most brilliant investigators in the field of dynamic meteorology, and has recently introduced some promising methods of research in this subject is a fact perhaps worthy of passing nonegle Institution's first and only contribution to meteorology. The allocation of the institution's funds among the sciences seems to outsiders a trifle capricious, but is possibly a case of "first come, first served.

The Paramoecium.-Of all the minswarms, there is perhaps none more re is sometimes called The most curious feature in connection with this form of the one hundred and seventieth genera-Some officers and employees of tion Were it otherwise, and the paravernment have expressly dedicated moeclum family should have a run of the earth and be themselves greater in hulk than the planet itself. should they survive to the nine hundredth generation, it has been estimated that the sun, moon and stars would be floating in a universe of them. The paramoscium is found in stagnant water.





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Researchy between Army plate and powerful wireless figns, have been installed at a. in Nebrasks, and Forts and Riley, in Kansas. The ment has ordered the use of agraphy in place of line telegfter between these posts. It se of the Department to exfinitess communication to other sports, so that they shall not be upon commercial service. Sta-seing equipped at Cheyenne and and others are soon to be in-

the in 1968.—The Censu seports that in 1909 the telegraph manhone companies, electric light companies, and steam and mar railways, spent over \$7,000,000 me purchase of poles. The number of meight was 2,739,000. Of these 78 ment were bought by telephone and companies. Nearly one-sixth of vere subjected to chemical rative treatment. The number of purchased in the previous year was chemically treated. By far the r number of poles in 1909, as here ee, were of cedar, the number being to the list, with 608,000.

stricity on the "Olympic." er plant of a modern transatlamble steamer is no small installation.

The steamer "Olympic" is to be provided with four units generating 2,144 horse This power will be employed in shting the vessel and for radiators in the first-class quarters; for cooking pur for operating various machines, ches, etc , and for running two nger elevators and eight freight ators. The lighting system will total 100,000 candle power. At present, while ng fitted up, the vessel is furnished electric light and power from a side. The tug is also provided with a steam fire pump for use in case of

tatinum is very close to that of glass. Consequently, electric lamps which employ a vacuum tube or globe of glass are fitted with platinum terminals fused in the glass Recently, in mercury vapor lamps quartz has been substituted for glass, so as to permit of higher tem-peratures and a much higher light effi-ciency. The expansion of platinum is greater than that of quarts, and hence is unsuitable for such lamps, as the seal is sure to break in a very short time. Instead of platinum, an alloy of nickel and steel, called "invar," has been employed. ugh the expansion of this alloy is greater than that of quarts, a tight s has been effected by giving the wire the form of a conical stopper, and then covering the seal with mercury to provide a hermetically closed joint A filling of cement prevents the mercury from spill-

An "Active-Lamp" Rate.—Residents of Ban Claire, Menominee, and Chippewa Falls, Wis, are being served with electricity on a unique basis. A distinction is made between "active" and "non-active" lamps. Lamps used in main halls d stairways, and in pariors, libraries dena, music rooms, conservatories and butiers' sentries are classed as "active". All other tamps belong to the son-active class with 'the exception of one 50-watt lamp on the second floor. Active lights lemp on the second fleor. Against lights are charged for at 15 givins per month for each 50 west unit, and in stilling to this there is a charge of 3 cents per kilowatt haur, on all the service, By this wystem the mes of electricity for coolsins and heating insuppose or for more and for lower antificious in the kitchen and former and for the service that the se

Engineering

Preposed Pittsburg-Lake Eric Canal.— The long-talked-of scheme for a canal be tween Lake Brie and Pittsburg is again being revived. The proposed cost of fifty million dollars to be divided between the three States interested, Ohio, Pennsylvania, and West Virginia, and control would be vested in a joint commission.

Locking Car Doors by Air.—What seems to be a practicable invention is a device for locking the doors of English railway cars by means of the air pressur-of the Westinghouse air brake. By mean of a conveniently located switch, the guard instantly locks every carriage door on the train. Similarly, all doors are kept locked until the train has come to a stop, when they are released by the guard.

To Build 14-Inch Guns at Watervliet .-It is likely that some of the new 14-inch guns of 45 calibers, which are to be nounted on our latest battleships, be built at the Watervilet arsenal by the War Department. Bids received from private concerns have not been altogether satisfactory, and as the greater part of the Waterviiet arsenal is now idle, the time would be opportune for placing a portion of the 14-inch guns at this fac-

Panama Electric Towing Engines, — The Isthmian Canal Commission will shortly advertise for 8,000 tons of material for constructing the tracks upon which will run the mastive electrical towing engines which will be built for towing ships through the Panama Canal locks Ordinary track adhesion would be insufficient for moving a 20,000-ton war ship. Consequently, a massive rack rail will be laid between the tracks, into which the locomotive will be geared.

The Ocean Graveyard, -Heavy is the toll taken annually by the sea of British shipping and the foreign vessels sail-ing near the English coast. Casualties were received by 10,650 vessels during the year, and 4,738 lives were lost. Of vessels belonging to the United Kingdom, 5,276 suffered casualty, and 322 of these were totally lost. The number of seamen and passengers saved from British wrecks, and wrecks of foreign vessels near the British coast, was 7,820

Curties to Train Military Scouts cording to the Army and Navy Journal. Glenn Curtiss, the aviator, has made a formal proposal to the War and Navy Departments, to instruct a number of officers who may be detailed for the puromeers who may be detailed to the pose, in aviation, without expense to the government. The training would be done over a mile course, and a special feature would be experiments over water to determine the best methods of rising from and alighting upon the surface.

Dimensions of the "Olympic."—The ex act dimensions of the new White Star liner "Olympic," as given out at the time liner 'Olympic,' as given out at the time of her launch by the builders, are 'Length over all, 882 feet 5 inches; breadth, 92 feet; molded depth, 62 feet; speed, 21 knots, and 34½ feet draft. The tonnage is 45 000 and the displacement 65,000 tons Corresponding figures for the "Maure-tania" are: Length, 790 feet; breadth, 88 feet; molded depth, 57 feet; speed 26 knots; tonnage, 32,000; and displacement,

Dreadnoughts of Small Size. — In these days of 32,000-ton dreadnoughts, it is interesting to note how much can be done on a limited displacement, as shown in the case of the three small ships of this the case of the three simil salps of the type, which are being built for Spain. Though these vessels are of but 14,700 tons displacement, which is less than that of the "Sonneoticut," they will mount eight 12-inch 50-callber guns of the most eight 12-incn s0-calleer guns of the most powerful type, and twenty-4-inoh guns, and will carry an 8-inch beit tapering to 4 inches at the ends, and they jurill have 5 inches and 10 inches of armor on the turests and barbettes. With 1,800 cons kilowest of coal, they will have a radius of 5,000

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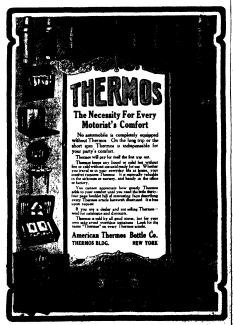
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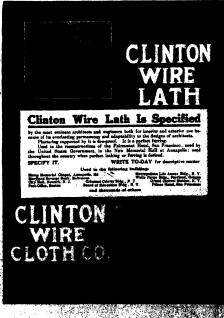
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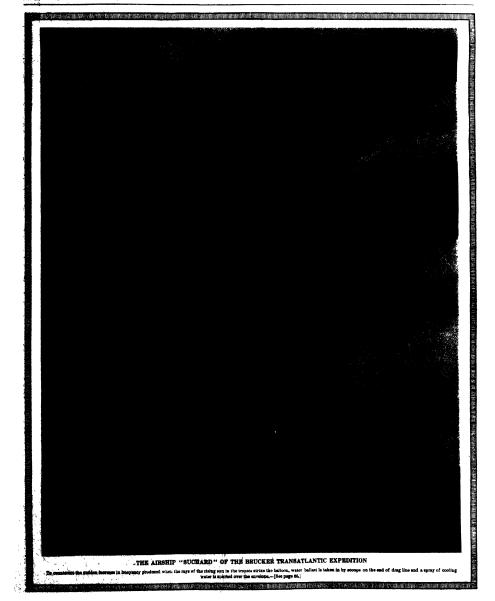


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WOMEN CIV.] *

NEW YORK, JANUARY 21, 1911

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SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, JANUARY 21, 1911

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The purpose of this journal is to record, accurately and in simple terms, the world's progress in securitie knowledge and industrial achievement. It wisks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and faccination of science.

Sex and Scientific Recognition

AD the incident occurred a quarter of a cen AD the medient occurred a quarter of a centre to ago we could have understood better the deceasion which has been provoked in that august body, the Academy of Sciences, Faris, by the candidature of Madame Curre for membership. Respect for custom and tradition is an admirable attitude if it be judiciously tempered by due considerations of time, place and personality, but we cannot help feeling that in this advanced age, in such a centr of enlighterment as Paris, and where a secutist of such brilliant performance as Madame Curre is concerned, this discussion as to whether she is clupble for admission to consum as to whether she is eligible for admission to the Academy of Sciences, is altogether deplorable. When science comes to the matter of bestowing its rewards it should be blind to the mere accident of sex; and one does not have to be an enthusiast on the subject of the extension of the rights and privileges of her sex, to feel that here is a woman who, by her brilliant achievement, has won the right to take her place with her compeers in the the right to take not place, with ner compeers in the Academy, or any similar institution devoted to the furthering of science. The secentific world will undoubtedly agree with Gaston Darbous, Secretary of the Academy of Sciences, in urging the right of Madame Curre to succeed to the position of which her late husband was next to the last occupant.

As far as the learned societies of other countries are concerned, the election of a woman to the Academy would certainly not be without precedent. Several foreign bodies, indeed, including the Philosophic Society of Philadelphia, have already welsophic vocacy or Infinitely in a large water the case of the Countes Ershin Lovatelli, who, as dean of the Archeelogical section of the Royal Academy of Italy, took a prominent part at a recent Academy of Italy, took a prominent part at a recent meeting of the Academy of Rome, and also that of Elist Wendel, who was a prominent figure at Berlin in 1900 during the cut unual criclibration of the German Academy of Sciences. To these cases we might add those of Herba Ayrton, the only woman number of the Institution of Electrical Engineers of Great Britain, who was considered eligible for election to that distinguished body, because of her discovery of the laws governing certain phenomena of the electric are, and that of Lady Margaret ot the electric are, and that of Lady Margaret Lindsay Huggins, who, because of her valuable work in astronous and her contributions to the journals devoted to that branch of science, was elected an honorary member of the Royal Astronom-ical Society.

Elsewhere in this issue reference is made to the fact that a statistical study of American men of science has led Prof. Cattell to draw attention to the fact that women are contributing but a very small share to productive scientific work. If this small is obvious that to contest the right to recog-nition of such women is further to discourage the entrance of women into a sphere of work in which their patience, intelligence, and strong intuitive per-ception render them peculiarly well fitted to labor.

Indorsement of the Reclamation Service

T is seldom that a report on an important public work has afforded us greater satisfaction than that recently made by the army engineers who were appointed to investigate the work so far done by the United States Reclamation Service. We were particularly anxious that the report should be favorable, and this for the reason that the engineers favorable, and this for the reason that the engineers in charge of this great project have been permitted to carry it on without that political interference which in the past has been so often disastrous to work of this character. The organization of the engineering staff of the Reclamation Service is excellent; the mega have been carefully selected; and they have done their work with an esprit de corps and seal which have won for this project the unqualified commendation of the technical press. The army engineers are noted for the strict impartiality qualified commendation of the technical press. The army engineers are noted for the strict impartiality with which they investigate public work on which they are called to report, and such criticians as they have made on the work of the Reclamation Service show that in this particular they have spoken without fear or favor.

For these reasons, the nation is to be congratu-lated on the fact that the board considers the engi-For these reasons, the nation is to be congratulated on the fact that the board considers the engineering structures of the various projects to be on the whole well designed and well built. "Some of them, as the Pathfinder Dam, the Shoshone Dan, the Roosevelt Dam, and the Gunnison Tunnel, are monuments reflecting great circuit on both designer and builder." Regarding the cost of the works, the Board states that it has almost invariably exceeded the original estimate, and that this increase in cost has naturally caused great discontent among the settlers. It was due partly to a general increase in the cost of labor and material; partly to underestimates and an meufficient allowance for contingencies; and partly to the necessity for doing more work than was originally contemplated. In justice to the engineers, it should be pointed out that at the time the works were started, the question of low cost was not made paramount, the Executive, indeed, having made it understood that every possible means was to be used to hurry forward the various understandars. The experience gained in these earlier works, however, has made it possible to estimate very closely the cost of the laker projects. In any case, it is a fact that although many of the works cost much more than was estimated, they have been built at a lower cost than works of the same character that were constructed at the same time in the eastern States. eastern States.

The Selden Patent

HE recent decision of the United States Cir-HE recent decision of the United States Cir-cuit Court of Appeals, reversing the decree of the lower tribunal, which upheld the famous Selden patent, marks the latest phase of this extensive and complicated series of law suits. The case is one of note mainly because of the vast commercial interests involved, and not by of the vast commercial interests involved, and not by reason of any new legal or technical principles de-termined thereby. The patent law and the decigions upon which the complainments and the decigions sought to support their respective contentions are, in the main, fundamental and long established, and the issue became practically one of fact. In view of this consideration, the present decision probably constitutes the final chapter of the litigation, for should the complainants apply for a writ of cer-tiorari, in order to take the case to a Supreme Court, it is doubtful if the latter will consider the case, as no question of law requires its determination. The parties to the suits embrace almost the critic The parties to the suits embrace almost the entire gasaline automobile industry of this gioutity, divided into two groups, in one of which are heladed the hecaned dealers, banded into an organisation con-ceding the validity and the broad scope of the Seiden patent and paying tribute to the owners thereof, in the form of royalty, in the other of which are found the independent dealers, who refuse to acknowledge the contentions of the owners of the patent, and thus became the defendants in the suits brought for the alleged infringement. alleged infringement.

alleged infringement. technical questions of validity and of scope, the Selden patent is an interesting one in that the application for it was filed sixteen years before the patent was granted. The investor, George B. Selden, himself a patent attorney, siled his application in 1879, and during its skillful prosecution took full advantage of the periods of inscrivity perainted by Patent Office practice, delaying its grant so long that the issue of the patent did not take place until 1895. When the application was filed, the automobile industry had barely received its inception, but in the period during which the application lay dormant, developed to such an ex-

tent that at its issue the patent discle the public which it did not then alres upon which, in fact, it had not alre-In this way came about the anomalous In this way came about the anomalous situates a pioneer patent appeared before the which purported to be a monopoly of an already well developed by others working pendently of the patentee. However, as a ventor followed strictly the statutes and procedure, the courts cannot exact of him a measure of diligence than he exercised. In an and scholarly decision, Judge Hough of the Clar Court says: "No litigation closely resembling a case has been shown to the Court, and no instructions of the court Court says: "No litigation closely restembling cases has been shown to the Court, and no in its known to me of an idea being buried in the state office, while the world caught up to and passed and then embodied in a patent only useful. tı ibute

tibute."

The Selden patent purports to be for a "selden patent purports of the present discussion of a safe, and the production of a safe, simple, and the patent purports of the present discussion purports of the present discussion between the patent purports of the present discussion between the patent purports of the present discussion between the patent purports of the present discussion purports of the present and patent purports of the patent purports inclination." The first claim comprises, in outsitation, its elements, all of which were old generically, in the prior art, at the time of the filing of the Selden application. This is admittedly the coantropy of the prior of aggregation was raised by the difference but both the lower and the appellate tribunds are agreed in holding that the claim is a proper combination. The combined elements in the claims are proper combination. combination. The combined elements in the claims may be arranged in three groups. First, the con-rispe, including the running gear, the body, the propelling wheel, and the steering mechanism. Sen-ondly, the drive, including the power shaft and connections, and the intermediate clutch or discon-necting device, and thirdly, the engine, including the power shaft and included the state of the claim are old in the prior ast, the custom of the constitution of the constitution of the constitution of fast: the question at once becomes a simple one of fact:
Did it require the exercise of the inventive faculty Did it require the exercise of the inventor landing to produce this combination, or if the combination itself was already indicated in the prior art, was any one of its elements so altered or adapted by the inventor that the combination thereby became pasany one of its rierusts so altered or anapted by a inventor that the combination thereby became pat-entable? In the claim, the engine element is the one-which required the most extended consideration. In fact, it is the essential feature of the patent. The prior art showed the elements per se of the claim to be old. It also showed a combination of elements similar to that of the claim, with the exception of the specific engine. But the prior art also showed a combination including a gas engine. Selden, in the claim, sets forth that the engine of the combination must be "a liquid hydro-sabu gas engine of the compression type." No such engine, in a similar cembination, was shown by the prior art. Judge Hough of the Circuit Court held that this constituted invention. The Circuit Court of Appeals, Judge Noves rendering the opinion, held in effect, that while there might be invention in the combination, the gasoline automobile of today does not use an the gasoline automobile of to-day does not use an

Noves rendering the opinion, held in effect, that while there might be invention in the combination, the gasoline automobile of to-day does not use an engine the equivalent of that employed by Selden, and that therefore, there is no infringement.

At the time that Selden unde his invention, the gas engine was alrendy well known, two leading types being the Brayton and the Otto. These two engines, while both might be classified as "liquid hydrocarbon gas engines of the compression type," are, it is held by the Appellate Court, not equivalent, and can be clearly differentiated. Without going further into the technical question of this difference, it may be stated briefly that the Brayton engine is practically non-existent at present, and that the Otto engine of Selden's day is the prototype of the intensal combustion engine now in general use. The Brayton engine is of the so-called slow combustion constant pressure type; the Otto of the combustion constant pressure type; the Otto of the constant volume, or explosive type. Judge Hough of the Circuit Court held that the estate of the articlarly permitted the Selden patent to be regarded as a pioneer one, and that correspondingly, it is entitled to a broad range of equivalent in its interpretation. For this reason, he regarded the Otto type of angine used in the gasoline automobile of to-day, as the equivalent of the Brayton type of those types of the lower court, and white admitting that the Selden patent is valid, and that it is to a certain extent of ploineer character, decides that the state of the prior art was such that the patent is entitled to a fall and reasonable, but not broad range of equivalents, and that this sange is not of such stages not permit the substitution of the "Otto types" motor for the Brayton nagine specializative court because of the Brayton nagine specializative court because of the Brayton nagine specializative court for the Brayton nagine specializative court because of the court of Appeals hereof differs from the decision of the "Otto

A System of Multiplex Telephony and Telegraphy

Major George Owen Squier's Gift to the Public

A N entirely new field in telephony and telegraphy has been opened by the patents just granted to Major George Owen Squier, of the United States Signal Corps, who, with remarkable generosity, has made his lawention a gift to the public. It is difficult to classify this new system of communication. It is not exactly wire telephony, nor is twireless telephony or telegraphy, but it occupies a position midway between, combining many of the advantages and elliminating many of

In wire telephony we have one of the most delicate and economical uses of commercial electricity, the amount of current employed being astonishingly small, but the very delicacy of the system makes it impossible to transmit a message to any considerable distance without sading the line with Pupin coils. Wireles telegraphy, on the other hand, is absurdly wasteful of electrical energy It is like using a blunderbuss to kill a gnat. In order to send a message across the Atlantic, we must create a tramendous disturbance in the ether on our side of the water, using many horse-power in elec-trical energy to start a set of waves that spread out with equal intensity in all directions, to the north, to the west, and the south, as well as reach the other side, it requires the modelicate of instruments to detect them and transossicate of instruments to octeet these and trans-form them into sound waves barely within the limits of audibility Of course, this defect of wireless telegraphy was recognized long ago, and attempts to direct the course of the waves only toward the receiving station for which they were intended have been made, but with comparatively lit-

tie success.

In his study of this subject, in connection with the work of the United States Signal Corps, Major

Squier has discovered that by reducing the frequency of the oscillations to a lower number than horestore used in wireless telegraphy, it is possible to direct the energy along a wire Affart thought, one would be inclined to question the advantage of such a system over ordinary wire telephony and telegraphy, but Major Squier has found that by means of proper attense, a large number of conversations may be carried on over a single wire at the same time, or, if desired, Morse telegraph signals may be used instead, without in the least interfering with the ordinary battery telephonic message renot conducted through the wire, but are merely directed by it, they are nor subject to obmir re sistance, as are ordinary telephonic currents, so that they provide a mean of communicating over much greater distances than have hereto-fore been possible.

The oscillations in an ordinary relughone circuit are limited by the lisertia of the disphragma in the receiver and the transmitter in addition to this, there is a limit imposed by the eart, which is unable to detect wheating of less than 14 per second and of more than 15, 800 to 20,000 per second. It is well known that in ordinary line telephony the current is distributed quite uniformly throughout the cross section of the conductor, but that as the frequenty increases, we have what is commonly known as "akin effert," this beling a tendency for the current to leave the heart of the conductor and seek the surface, and eventually with further increase of the frequency, to leave the conductor entirely and be stored in the ether surreconding it. A still further increase of frequency results in radiation of the energy from the conductor, as is wireless telegraphy Major Siguier has found by experiment that frequencing to 10,000 cycles per second are so bound to the conductors that there is very little radiation to the conductors that there is very little radiation.

to the conductor that there is very little radiation. The frequencies used in wiveless telegraphy ranke from this point up to several million per security and algorithms and the several million per security and algorithms are several million and that or in the several million and the total million and the total million and the total million and the several million of a series of wave trains along the wirt, which are quite distinct from seach other, and which may be selectively experiment for recording instruments that are respectively experiments with the transmitting instru-

ments. Using these wave trains as vehicles of communication, it is a simple matter to impress one them variations and modifications corresponding to the human voice by means of microphone transmitters, as in wireless telephony. The receiving instrument



Fig. 1.-New system bridged across a telephone line.

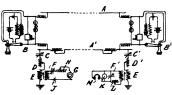
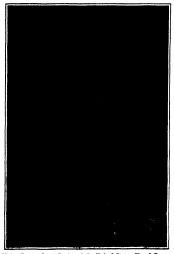


Fig. 2. -The grounded multiplex system

will then pick up the particular wave train to which it is attuned, and, by means of detectors and receivers, such as are commonly used in wireless telphony, will reproduce the human voice Apparentic the vexing problem of multiplex telephony has been



Major George Owen Squier of the United States Signal Corps.

A SYSTEM OF MULTIPLEX TELEPHONY AND TELEGRAPHY
Photographed by Harris & Walng.

completely solved. Major Squier's invention is capnable of a large number of different applications and modifications, all of which have been carefully covered in four patents. We have selected two drawings from these patents, one of which represents the highfrequency system bridged across the wires of a common telephone circuit, while the other shows a highfrequency system introduced directly into our of the wires of a battery telephone line, while the earth is used as a return.

In Fig. 1 we have a telephone line indicated at AA'.

Any ordinary telephonic circuit may be used Major

Squier in his experiments employed the regular
twisted pair of paper-insulated, lead-covered cable.

The ordinary receiving and transmitting telephone sets are shown at BB', bridged across the line. A high frequency circuit is also bridged across the line, consisting of a condenser C, variable inductance D, and the primary of a transitioner E. The secondary

of this transformer forms part of the generator control of the property of the transformer forms and of the generator of and microphons transmitted J. The recenting set of the high-frequency system is indicated at the other end of the line consisting of condenses 12°, variable the doctance D standard of the line consisting of condenses 12°, variable the obstitute of the variable inductance D, detector K, condenses P and received M. The variable inductance L detector K, condenses P and received M. The variable inductance L detector K is of the type commonly cut to the frequency of the type commonly cut to the frequency of the type commonly employed in whelease telegraphy. While these varieties of and C, which are of very small capacity, being measured in thousandthe of a microfarad. These condensers also prevent currents of ordinary telephonic frequency from alrecting the high-frequency receiving sets in order to adapt this system for a large number cleding the high-frequency receiving sets in a microfarad from the maniform of high frequency sets operating at the same time, the primary of the transformer E may be made variable or other means may be adopted to provide for selected tuning. Instead of bridging the lines of the telephone circuit, it is possible to superpose the high-frequency was

upon them inductively by placing the seondars of the transmitting station and the primary of the receiving station in series with the line. In Fig. 2, which shows the grounded system, the parts corresponding to those shown in Fig. 1 are

parts corresponding to those shown in Fig. 1 are similarly lettered. The inductance coll H provides for the necessary attunement of the generating circuit, and the variable inductance L for that of the oscillatory receiving circuit. In addition to this, tuning colis are inserted in the line to as sist in careful attunement. By using the earth

sist in careful attanement. By using the earth as a return, it is possible to employ the two wires A and A' as separate circuits, thus further increasing the number of communications possible over a single commercial telephone circuit. Major Squier's fourth patent also covers a grounded switch, in which a number of high-frequency circuits are connected in series relation.

It is difficult to foretell just what Major Squier's investions may lead up to The fast that they do not require any special apparatus that has not already been tried out either in wire telephony and telegraphy, or in wireless systems, makes them doubly valuable It seems remarkable that electro-magnetic waves may be employed within the calibes of a telephone system but Major Squier has found that the oscillations appear to be confined in the infinitesimal layer of ether separating the wires of a twisted paper-insulated part of telephon conductors. The commercial possibilities of this high frequency line telephone appears to be very promising indeed, and we owe Major Squier a large other grantitude for placing this fundament ally new mode of telephony absolutely at the disposal of the public without the exaction of

It was the invention of the mesmograph for the study of earliquakes that led to the discovery of the astonishing sensitiveness of the crust of the globe to forces that might have been thought too insignificant to cause discount of the message of stores is the alteration in the pressure of the atmosphere during the passure of storms, causing a perceptible tilting of

are of storms, causing a perceptible (filling of large areas of ground A curlous case of such tilting has been recorded in Japan A storm passing over the sea east of Tokyo caused the bordering land to tilt down and, notwithstanding the fact that atmospheric pressure is lessened within a storm area. This is explained by the fact that the sea rises with release of atmospheric pressure and the accumulation of water more than sufficed to counterbalance the decrease in weight to the air.

Varnished Drawing Paper for Geometers.—The paper must be coated, on one side, 4 to 5 times, with thin solution of abeliae in spirits of wine and then coated three times with a varnish composed of 1 part asohalt. 8 lineed oil varnish and 2 fat copal varnish,

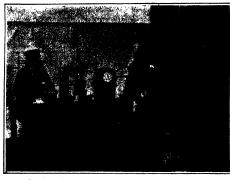
The Man-Machine

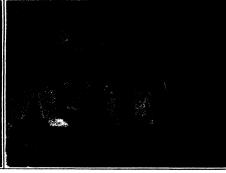
The Remarkable Perfection of the Human System as a Mechanism

By John B. Huber, A.M., M.D.

PROF. JULES AMAR has reported to the Academy of Releaces in Paris a study of the human machine, made on the principle that a man who ests liberally ought to recuperate in weight every twenty-four hours. If his weight lessues he works to excess; if, on the other hand, his weight increases, he has not

Alps, and the relief came to Lucknow." The Autocrat of the Breakfast Table observed that "the nation which shortens its swords increases its boundaries." nor has modern ingenuity ever invented a deadlicr weapon than the short sword of the Roman—the most destructive of all weapons—because the man wielding he, however, always wastes energy during the first five minutes of work, before regalating his equilibrium. Monday's human labor, moreover, is the mostinferior and Tuesday's the most superior, owing in the curious action of Sunday as a rest day. The Monday leastitude of the French workman is pre-





Experimental bicycle for measuring the work done by the rider.

Apparatus for collecting and sampling expired gases

expended the maximum effort. Hundreds of measurements, covering a considerable period, convinced Amar that the human machine gives a profit of 25 to 30 per cent on the expenditure; but that the best artificial machine return colv. 14 per cent

machine returns only 14 per cent.

Man is superior to all mechanisms. Weston, in the
most recent of his feats, demonstrated above all
things else (in so far as an individual could) that
the human organism is not only the greatest psychientity on earth, but also that this superlative mind is
closed in the most expalse and serviceable machine
that breather and uses muscles. The genus homo has
had to drop the medieval assumption that the cosmos
exists for its especial behest; although we may some
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It has the courage and stamina to get sufficiently close to the enemy to drive it in up to the hilt. It was not chiefly the sword; it was the mon with the sword.

Suppose today a good horse, a good automobile, and a real man were to start from the Best for San Francisco. The first two would no doubt disappear before the latter had reached a milepost; but the man would most likely, somewhere this side the Missispip, come upon the horse laid up in a bearding stable; and upon the motor towed to a repair shop with a wrenched axis. In a race for a month or a year man need not sak a handicap from any other vertebrate; nor has he ever devised a machine which can get him over obstacles and transport him without varied conditions so surely, safely, and confortably as will his own legs.

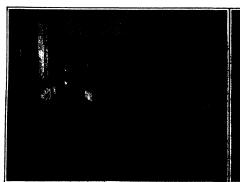
To return to Amar: He found that soldiers ought to

as will als own legs.

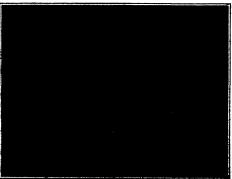
To return to Amar: He found that soldiers ought to
be able to march thirty-five kilometers (twenty-one
miles) a day at the rate of five and one-half kilometers (three and one-third miles) an hour, carrying
forty-five kilogrammes (ninety-nine pounds). Negroes,
studied by him in Algeria, show superior resistance,
but less intensity, than white men. Though man is
superior to all mechanisms, especially in delicacy,

verbial; and no doubt he is not alone in this phenomenon.

But what is failgue? This question has been excellently considered in Harpers' Magazine: Patigue is the cry of the builders for more material, when the supply has given out, by reason of excess of efficient Every muculy and the supply has given out, by reason of excess of expensions and fested by heat, which results in perspiration and fested by heat, which results in perspiration and the senantion of warmth on exertion. All combustion, either within the sentient body, or in nature outside of it, is a chemical combination of the atmospheric oxygen with other elements of the substance consumed—coal, gas, or animal tissue. In mucele contraction there is combustion—a combination of the oxygen in the blood, with stored-up material (glycogen) in the muscle; and thus is produced the bodyly heat. Shivering in cold weather is a refex, by which the body supplies itself with heat through combustion in the muscle. Normally the body temperature in man and warm-blooded satimals is kept particularly at a constant level favorable to the chemistry of life processes; this temperature is in fact due to these processes. At times this automatical heat regulation falls; then result numbness and in
(Continued on page 72.)



Comparative experiment with a guinea pig.



The Amer was confined anniversary

Transporting Living Animals with the Aid of Oxygen

Specimens Shipped from New York to Germany

By Dr. Raymond C. Osburn, Assistant Director of the New York Aquarium



VERY interesting experiment in the transporta-tion of squarium specimens has recently been under by W. Smil Gundeland of dealbers, German, with this assistance of the New York Aquar-ium. Arrangements were made for the ship-man of the command of the command in the command in the command of the command in the command in sch's home in Germ to Mr. Gundeb

he following manner:

Rixbem 3-liter glass jars were filled with
rater, and the specimens introduced. The jars were then inverted under water, as in a presumatic trough, and oxygen gas intro-duced to replace the water until the jars were about one-third full of the oxygen. The jars were then tightly corked, and cov-The jars were men usually contain any escape ered with parchment to prevent any escape ... of the gas. They were packed in crates and shipped at once on the North German Lloyd steamer "Kaiser Wilhelm der Grosse" on the morning of September 18th.

The list of specimens put up by th ium for this experiment was as follows: Common sunfish (Eupomotic gibbosus),

Variented minnow (Cyprinodon varie-

Cunner (Tautogolabrus adspersus). Beau Gregory Eupomacentrus leucostic-

Star corals (Astrangia danae). Sea anemones (species undetermined). Tunicates (Molgula manhattensis).

Tunicates (acquisit mentions).

Common shrimps (Crangon vulgaris)

Horseshoe crabs (Limulus polyphemus) a

couple of dozen of young just hatched, and

one so large that it could not straighten out

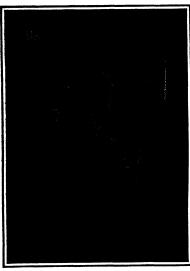
Fiddler crabs (Uca pugnax), several specimens in wet sand with an atmosphere of

This widely varied selection was purposely made by me to test the possibilities of the

An extract from Mr. Gundelach's letter of September 25th, acknowledging the receipt of the specimens, shows what succ "The collection arrived at Gehlberg on the evening of September 22nd. Notwithstanding the length of time (over nine days) the specimens reached my home in safety. The Beau Gregory and the Cunner got chilled because the temperature was too low, and both of these fishes died the next day, but all the other specimens live and are in the best of condition. It is very important

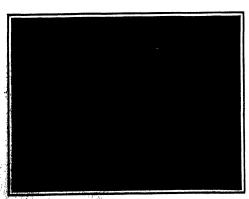
that the experiment has succeeded, and you can now exchange specimens with any European insti-tutions in this way."

In order to know what losses, if any, might be laid to temperature, Mr. Albers, second officer of the ship, kindly consented to make daily records of the temperature of the room in which the crates were placed, throughout the voyage. His report indicates a gradual decrease from 78 to 66 deg. F., and Mr. Gunfrom 18 to 66 dag. F. and Mr. Gun-deach liftorms me in he letter that it, was as low us 65 in Ger-many at the time the specimens arrived time. The Beau Gregory, though a troubless light, withoutly did assecusible to the signal but the Cun-process of the contract of the con-traction from will not apply the three from the comply of the contraction, was probabily two large the time and the supply of the contraction of the con-traction of the con-traction of the contraction of the con-traction Of course, the journey was made entirely without food. Mr. Gundelach had previously made successful experiments in shipping for the shorter distances in



Packing the specimens in crates after treating with oxygen.

Europe, but nothing paralleling the present experiment has thus far been undertaken. The particular advantage in this method is that specimens can be sent apparently any distance without any care what-ever during transit, thus doing away entirely with the expense of an attendant or any special machinery for aerating the water.



Partly filling the jare with oxygen, using the pneumatic trough. BRANSPORTING LIVING ANIMALS WITH THE AID OF OXYGEN

S INCE 1892, when Prof John Mulrhead Macfarlane (now director of the botanical garden at the University of Pennsylvania) found that the leaves

of the Venus Fly Trap will close up only if the trigger-hairs are disturbed twice in succession, very little has been learned about the physiology of this curious insectcatching plant. During the past year, how-ever, some new experiments have been made that bring the behavior of this plant into line with the behavior of animals in certain respects

The leaves are sensitive to mechanical disturbances, to electrical stimularel disturbances, to electrical stimula-tion, and to the sudden increase in temperature as through the application of warm water. At ordinary temperatures, it es two stimulations to set up the sponse, but at higher temperatures-35 deg to 40 deg C -- one "shock" will cause the leaf to close At ordinary temperatures, one electric shock will produce the effect if it is strong enough. In applying electrical stimulation it was found that the leaves were much more sensitive to the opening of the circuit than to the closing interesting results were obtained in experiments with "subliminal" tions, that is, shocks that were below the limit of intensity necessary to secure reac Here it was found that the plants may respond to a summation of stimuli In the case of electric shocks, intervals of fifteen seconds still permitted a summation of effects of very slight disturbances, while with mechanical disturbances the effects were still more persistent. For example, two to five very delicate disturbances of the trigger-hairs at intervals of one minute duced the same effect as two ordinary disturbances at a very short interval; when the intervals were increased to two minutes, it took from five to seven stimuli to bring about the closing, when the intervals were three minutes, it needed six to nine stimuli

On the other hand, if the intervals were too short, there was no response. At ordinary temperatures, the two stimuli must be at least threefourths of a second apart, at 35 deg to 40 deg not less than one-fourth of a second. This is exactly like the condition found in the muscles of animals, where there is a short period following a stimulation, during which a subsequent stimulation produces no effect

On carrying out the well-known experiment of passing steam through a mantle surrounding a barometer tube containing a small quantity of water, Mr F R Watamount of depression of mercury had taken place the latter began to oscillate about a point corresponding to the line of condensed steam in the mantle. During the scillations the mercury continued to descend as the line of condensed steam descended The experimente explains the phenomenon on the same basis as Griffiths explained the action of a hot-air engine mercury goes through a complete cycle during each oscillation, absorbing heat at steam temperature. and giving it out to the cold tube lower down. It becomes cooled also by the work it does in panding It is then pushed back up the tube from below, its "re sure being less than when expand-ing, because its temperature is less. Therefore more work is ione during expansion than con-

The Brucker Transatlantic Airship Expedition

By Carl Dienstbach

T was during the closing years of the nineteenth A century, directly before Santos-Dumont, Count Zeppelin, and the Lebaudy brothers demonstrated the practicability of the motor-driven balloon, that the boom of the time-honored drifting spherical balloon was at its highest.

The use of improved material and new methods of navigation, based on the teachings of meteorology, provoked such feats as Count de la Vaulx's still surpassed record flight from France across Germany, far into Russia, and such ambitious enterprises as Andre's ill-fated ascent from Spitzbergen in quest of the north pole, and again Count de in Vaula's attempts to cross from Marseilles over the Mediterranean

scientists and engineers in France became interested in the plan of sending a balloon drifting with the trade wings from Africa to America. This idea was, of course, not new America's greatest poet, Edgar Allan Poe, suggested it in a novel which anticipated H G. Wells in graphic realism, and in France it had been proposed in all seriousness even previous to bean proposed in an seriousness even previous to this. For a number of years the suggestion had loomed up from time to time in the press of both hemispheres: Yet nothing ever came of the two French properts. Then the dirigible airship sprang into being, opening another avenue to the spirit of aeronaurical enterprise, and temporarity relegating to the background the all-important art of navigating the air with the assistance of meteorological forces. The drifting bal-

loon had perforce turned the efforts of ioon had perfore turned the enorts or aeronauts into this direction. The air-ship, on the contrary, at first caused the entire neglect of this field. It was the idea of the first "aerial motorists" that the wind was there to be fought. They wanted to drive through the air as an automobile is driven over the patient roadway in any direction and at any time, according to their own sweet will. indeed, the early airships had such a short radius of action, both as regards tength and height of flight, that their pilots made a virtue of necessity in heading straight into the wind for a goal which they had no time to reach by tacks and byways Lack of lifting power prevented them from rising in seas a more favorable current, as had been the practice of the spherical balloons. The only remedy suggested for the difficulties encountered was increased speed. Count Zeppelin alone made it his first aim to increase the radius of action since in this way he thought an airship might be made to "outlast" a storm.

might be made to "outlast" a storm.

To Walter Weilman, the American, belongs the meets of having been the first to attempt the construction of the moto-driver "improved spherical" balloon; giving it a greatly increased radius of action, the proposed light to the north pole could hardly have succeeded without more preliminaries than his limited means enabled him to undertake His attempt to cross the Atlantic from west to east in the temperate zone with substantially the same airship that had been designed primarily for the materially different purpose of an Arcile expedition, was "experimental" in a dangerous degree. Credit must, however, be given to him for sacrificing his craft in the first endeavor to put fascinating theories of wide airship travel into practice But We wide airship travel into practice But Wellmany cocan-crossing dream had been articipated in Germany on the initiative of a German-American, Joseph Brucker. Whether Brucker's plan meets with complete success or not, it will represent a new milestone in the history of aerial navigation. It will revive the dolf French idea of crossing the ocean with a balloon, modified, however, to this extent, that the craft employed will be a motor-driven airship representing the very latest product of the German aerial dock-varia. But Wellman's

Mr. Brucker owes the realization of his plan to the great aeronautical exhibition held during the summer 1909 at Frankfort-on-the-Main, Germany, during which he met in conference with the assembled meteor-ologists, aeronauts, and "aerial architects." The moving spirit of the exposition, Dr Ganz, a noted scienseronaut, and sportsman, saw chances of succe in Baycker's plan He became director and consulting engineer of a company founded to realize the enterprise. In April, 1910, the company received its charter under the name "Transatiantische Fing Expedition", orthogram (Transatiantic Airship Expedition), with

a board of directors comprising some of the forest scientific and commercial leaders of Germany. Brucker himself holds the office of manager. Ganz, the president, subscribed a considerable amount, but the well-known Swiss firm Suchard has guaran-teed to meet most of the expenses. The airsalp is accordingly named "Suchard." Many months were accordingly named "Suchard." Many months were spent by Dr. Ganz and Mr Brucker, together with the naulting engineer Mueller-Peissenberg, in consulting engineer muelier-reisseneers, in comput-ing the form and size of the vessel, especially the equipment of the car. This car is designed in the form of a seaworthy motor boat. It is worthy of notice that such famous persons as Prof. Hann of Vienna and Dr. Koeppen of Berlin have given their

enthulastic indorsement to the enterprise.

The balloon was built by Mr. Riedinger in Augsburg, and the boat at the boat yards of F. Lucessen in Aumund-Vegesak. The balloon is of the type of the big "Parseval VI." but is of a modified pattern. It is sturdier, 60.5 meters long and 17.2 meters in maximum diameter. The greatest width is situated at the first third of the total length, as is typical of at the first third of the total length, as is typical of Prof. Prandit's Parseval-shape. The storn is sharply pointed, the bow egg-shaped. The envelope has a body of 9,400 cubic meters. The ballonet is very large, comprising more than one-third of the entire volume; it measures 3,500 cubic meters, which is equal to the total displacement of a typical French airship. This insures a rigid hull, even after very extensive loss of gas, and enables the ship to contend with

BE ELEVATION

The spraying system and bucket line of the "Such

the most extreme conditions that are likely to arise in the course of a long voyage. The designers of the "Sudiard" centered their efforts upon the production of a craft which should not only have tremendous of action, but should at the same time the highest attainable degree of safety. Both of these the nignest attainable degree or sarety, not of these requiremental-could be resilted in building a ship of ample size designed for low speed. The weight saved in machinery could thus be applied in making a thoroughly strong structure, and in equippling the airship with proper safety appliances. The etwicepes is made of a special fabric manufactured by Metselve of Munich, with three layers of cloth, two of rubber, and a light rubber cost on both surfaces. This, to gether with the large volume and the ratio of four to one between length and diameter (resulting in a comparatively small surface per unit volume) seen to guarantee excellent gas-retaining qualities. Ever the "Zeppelin VI.," which was burned at Baden the "Espeain VI." which was burned at Baden-Baden, retained its gas for many weeks at a time in almost daily service. In the "Suchard," gas loss by diffusion will be absolutely negligible as compared with gas escaping when the safety valves are oper-ated under the influence of the heat of the tropical sun. This latter loss is to be reduced to a multinum by a special patented device, which is perhaps the most important feature in the entire design of the atrebip. No balloon built hitherto has had santhing atrably. No balloon bulk litherto has had santhing like the endurance which the "fluchard" will have, and it is for this reason that even with the best spherical-halloon, crossing the occas, was, my to the present, an impossibility. The "fluchard" will good to be the fact that the route will be entirely out miles and will draw advantage therefrom, at working the low, to present; control its floating power. Anything to be the second of the second

use. When we consider that it will have to authorize the extreme change from night to tropical day owe water from five to seven times, it agrees; at first sight as if the whole enterprise were simply feed hardy. Even a single change from night to day causes most serious difficulties to ordinary stratings on land. The plan which the designies of the "Suchard" have formed to meet these difficulties correlated and the state of the st remains to be seen whether the technical execution of the device as it stands now will prove capable of realising what is expected from it. It seems provable that the proper manipulation of the apparatual will require great still and much practice. The plact is to scoop water as ballast, whenever needed, with scoops or buckets carried on the and of a steaf cable. These buckets are made of sheet steel, of a shape designed to cause the minimum amount of drag while filling. Each holds 25 liters, and has four holes in front to admit the water to enter. Thres or four of these buckets are attached by means of short lines to a wire cable, of one centimeter diameter. They fill to a wire case, or one centimeter diameter. Free in automatically and rapidly in consequence of the mo-tion of the ship. Although they can simply be dropped into the water, so that the action takes place immediately, the effect of the sun's rays also is very sudden, and it would not be safe to depend on this device alone. It is supplemented by a movable weight, which regulates the inclination of the keel. By the aid of this arrangement, a certain amount of lifting or down-

ward force can be called forth by ne plane action through the motion of th ship. But the most important feature is an original device for cooling the envelope with running water. Light water-tight canvas hose extends from the boat to the top of the balloon, where it en-circles the gas valve, and then extends backward along the balloon. This tube is provided with a large number of per-forations along its sides, and ends in a

hard rubber spray nozzle fore and aft.

From a tank in the boat water is pumped through the hose and, issuing from the holes and nozzles, flows in a thin film all over the envelope. The 18mile breeze produced by the ship's moevaporation of this water, resulting in an intense cooling effect.

It is planned to make a number of trial trips with the "Suchard" before em-

barking on the actual trip with the trade wind, which allows of no return.

These trial trips may represent the weak point of the enterprise. For they will have to be made in German, where the weather in winter is not favorable even for airships making over 25 miles an hour. But

or course such trial runs are indispensable, for the water-accoping and water-spraying apparatus will certainly require not a little skill in handling.

sibility of giving the operators such full and adequate preliminary experience as would be desirable in the management of their craft under the conditions of the actual trip, is in a measure compensated for by the very placid character of the waters over which they will sail.

The endurance of the motors under conditions such as prevail in the tropical seas during the early months

es five well as the violent seed than the entry months of the year, might, on the other hand, very well be tasked out in the shop.

The "Buchard" will be equipped with a regular workshop, which will be most valuable for executing any repairs to the motors that may become necessary uring the trip. In the light of Wellman's experiences, Brucker's

In the light of Wellman's experiences, Brucker's success seems to depend essentiality on his skill maddling the well-recoping and spraying apparatus, and on his ability to prevent the crask from rising anduly. If he succeeds in swiding ask losses from this cause, then he can hardly fall to reach America, swell fit his robotre gipe out. His buildened is so large that it should be quite ability. He had been also become successful to the gas. The agnification appointed to construction of the gas. The agnification appointed in the successful to the successful the successful to the successful the successful to the successful to the successful the successful to the successful the successful to the succ

(Constitute in page 142) (C. 3)

ur Smokeless Cannon Powder the Best

I branches of our service to-day is probably more nearly perfect than any other that has yet been produced abroad. Furthermore, it is entirely an Am can production. Not one icts of its form or composi-tion was derived from any foreign source.

The four chief desiderate in a smokeless powder

First, that it shall be a stable compound; that it shall keep long enough for all practical purposes under varying conditions of climate and storage. Second, that it shall produce high velocities with

Third, that it shall, for given pressures, have the

minimum of erosive effect upon the bore of the gun. Fourth, that it shall give regular pressures, that if to say, that it shall siways behave alike, giving

res under like conditions.

Now, the merits of foreign powders, with respect to the above four essentials, are well known both to our powder manufacturers and to the powder experts of our Army and our Navy. It has long been a source of general gratification and satisfaction that our smokeless powder is not only superior in certain respects to foreign powders, but also in each one of the above four most important respects it is decidedly We are getting higher velocities, superior. ower chamber pressures, than are obtained by any other government in the world. There is greater regularity of chamber pressures; there is less erosive ffect upon the guns; and no foreign smokeless powder equals ours in chemical stability.

The first smokeless powder to be adopted by this government was produced by myself and my assistants Maxim. N J., and was known as the Maxim-Schüpphaus smokeless powder. It was made in short,

powder, in a vein so preposterous as to elicit from Secretary Meyer the assertion that are unworthy of serious consideration except as to their misrepresentations and to the evil effects of their wide publicity on those unacquainted w subject

In Sir Hiram's letter he frequently referred to an article printed as an editorial in London Engineer . The pronouncement of Secretary Meyer may applied equally well to the statements contained in that article as to those contained in the letter of Sir Hiram Maxim to the President. It is stated in the said article that artillery experts, both in England and in the United States, are strongly of the opinion that the accidents to some of our large were not due to any fault in the design or manu-re of the guns, but were due to the use of guns were not use to any saul in the design or manufacture of the guns, but were due to the use of multi-perforated powder. Then follows a remarkable history of an accident which occurred in 1889 to a 10-linch gun at Sandy Hook. This history of the accident is remarkable for being an account of exactly what did not happen; just as the statement th lery experts in this country blame our powder for the accidents that have happened to our guns is remarkable for being the exact opposite of their

The ignorance of the subject displayed by the author in the article referred to is manifested by many statements so palpably contrary to fact, that it is a wonder that anyone at this time with any experience whatsoever with smokeless powders and ordnance could be so uninformed as to make them

Take this statement, for example: repeatedly found that multiple-perforated will not stand the heat test." It is difficult ple-perforated powder It is difficult of comprehension how anyone could think that the physical shape of the grain could have any effect whatsoever upon its chemical stability. How could the fact that a grain of powder has several holes running through





Partly consumed grains of 12-inch gun

se powder of various forms and sizes to suit different calibers of naval guns.

round cylinders, about three diameters long, the cylinders being multi-perforated longitudinally with seven small holes, by a process invented and patented by me. The powder consisted of eight per cent soluble rocellulose lose and ninety-two per cent of tri-nitro-This composition, however, was later abancellulose. doned in favor of a pure nitrocellulose colloid made by the use of ether and sloohol, with a special form of nitrocellulose developed by naval officers at the Newport torpedo station. This has been our service powder ever since No nitroglycerin has been employed in our cannon powder during the last twelve

e character of granulation for each gun, and all the steps in the processes of manufacture, and the tests for determining the chemical stability of the tests for determining the enemical stability of the final product, are determined upon and supervised by government officers, whose intelligence, scientific training, and practical experience are certainly not excelled, even if equaled abroad. All results of firing in guns of all sizes are carefully and methodically behavior of the product of the pr tabulated for future reference and guidance.

The form of multi-perforated graips now in use was d upon and adopted only after most exhaustive decrease upon and anopean only act most extended to testa, had been made with many other forms of granulation, including every form in use in foreign countries. Not one step is taken, either in the process of manufacture of our powder or in the size or form of, graips, ustil it has been proven by ample experimentation. The great smokeless powder plants of the Eq. 1. du.Pont Powder Company are probably the lar-spet, most scientifically constructed, and most intellimet, now scientific operated of any in the world; said: had carefully operated of any in the world; said: the government officers and the officers of this cincians co-operate in perfect harmony with the co-cingua aim of estaining to the bighost possible em-

aget aim of estaining to the lagrant possible emission and manufacture and perfection of product. He remoter, then, that our Navel Scoretary Mornal our Chief of Ordanaco of the Army, Principiler, 1988. A contract of the Army, Principiler, 1988. A contract of the Chief Strain States in the Chief Strain States in the Chief Strain States and Second St. Strain States St. Strain St. Strain

possibly render it more unstable, and thereby vitiate the heat test?

The author refers also to a detonation of the powder charge having taken place in the 10-inch gui which had its breech block blown out at Sandy Hook , and in the 12-inch gun which burst on the a" The 10-inch gun referred to simply had 'Georgia ' "Georgia" The 10-lien gun referred to simply and its breech block blown out, an accident due to faulty construction of that mechanism Although the par-ticular lot of powder used at that time was of faulty construction, many of the grains being porous and varying widely in size and character, and although the powder contained a small percentage of nitro-glycerin, still the charge did not detonate; for, had it detonated, the entire gun around the powder chamber would have been blown into fragments; and had the powder charge detonated in the gun which exploded on the "Georgia," the same effect would have een produced.

The author of the article also refers to Sir Illiam as being the first to make a smokeless powder by combining tri-nitrocellulose and nitroglycerin and refers to the use by Sir Hiram of castor oil in that patent as something important and useful It is interesting, at this time, to examine Sir Hiram's record as an inventor and developer of smokeless gun-He never had anything to do with the m facture of explosives on a commercial scale, and nothing invented by him in explosives has been adopted by or employed in the service of any government in the world His only experience with explosives was limited to a little desultory work in a small improvised leboratory at Crayford, England

At the time of the suit of Measrs. Vickers, Sons & Maxim, referred to in the said Engineering article, it was proven that the only valid claim in Sir Hiram's patent was for the use of castor of. It was proven that there was nothing new in combining tri-nitro-cellulose with nitroglycerin to produce smokeless powder—that Nobel had made such a compound and patented it in England in 1875, in which patent he (Qualitated on page 72.)

Move to Sell Patent Office Models

THANKS to the vigilance of Representative Bennet, of New York, another effort to sell the invaluable collection of Patent Office models has been frus-A clause had been inserted in the Legislative, Executive, and Judicial Appropriation bill, authorizing the superintendent of the Capitol buildings and grounds to sell within sixty days, all of the patent models now stored in the basement of the House office building. On calling up the Commissioner of Patents. the Representative found that Mr. Moore had for many years entered his most emphatic protest against any suggestion that the collection of models should be osed of in any way. The paragraph was ruled of the bill, and for the present at least, the collection of models will be safe

A few years ago a similar effort was made to get rid of the collection but was thwaited in the Senate Committee on Appropriations At that time, it was argued that the room occupied by the models in the Interior Department was needed for other purposes. out the collection was saved by being stored in the House office building, where the 134 000 models class! fled and boxed up, are now preserved

There are reasons, both sentimental and practical for saving this unique collection which includes the original models of many of the epoch making invenwere burned, and but a few of them have been to stored.

Additional models to the number of 86 000 were destroyed in the Patent Office fire of 1877, but there is a sufficient number remaining to form a collection of indisputable value. In proof of this it is sufficient to mention the sewing machines of Howe. Wilson, Singer, Willcox and Gibbs, and others: the Morse telegraph instruments, of 1830 to 1840, the Bell solve teegraph instanting, or 1880 to two, the Fer-telephone, of 1876, the Edison phonograph, of 1878, and his electric lamp, bearing date 1880, the House printing telegraph, of 1846; Thurber's typewriter, of 1843; and the beautifully-built and operative models of the work of Hoe, Bullock, and Gordon in presses and the allied mechanisms. Here also is the timeclock of Savage, of 1847, the arc lamp of Collier and Baker, of 1848; and the old electric motors of Davenport. Neff. and Edison

The practical value of these models lies in the fact that in early days, drawings and sketches were incomplete, and it was necessary to depend upon the model for the disclosure of the details. Hence the models were an indispensable part of the records of earlier patents.

The Patent Ray Association is on record as strongly in favor of the preservation of the exhibit, arguing that it is impossible to establish any standard by which to determine the relative importance of a model. and that none of the monels which form part of a patent should be disposed of which can be useful as a record. The model which seems to be of the least importance to-day may, because of future developments, be of the greatest importance to-morrow. The Commissioner of Patents states that he is required orders from various courts during the year, to send out several hundred of these models as evidence in contested patent cases. This statement of Mr. Moore, referring to conditions which will be true for all time, should be sufficient to settle, once and for all, the question of the preservation, intact, of this valuable exhibit

The Current Supplement

THE front page of the current Supplement, No 1829, shows two excellent views of Mount Sinal, the "Holy Mountain" of Bible lands A number of other views, with an exceedingly interesting descrip-tion of recent explorations in the Sinai peninsula, will be found in the body of the paper—D: Victor Quittner takes up the subject of magnetic crystals. explaining their peculiar properties - A summary of the proceedings of the annual meeting of the Geological Society of America is given by E. O. Hovey There is an article on the subject of power production from solar radiation, outlining the proposed plan for the commercial utilization of power from this and other intermittent sources. While the same subject is taken up on another page of this journal, the article in the Supplement will be found to go into the matter in greater detail—The discovery of vanadium in a brown lead ore from Zimapan, Mexico, and the sub ment history of this metal, are outlined in one of the articles.—The development of submarine boats is concluded from the previous number

Our big game animals are constantly diminishing in numbers, and unless protected will soon disappear The chief function of the federal government in this connection is to stimulate and co-ordinate the action of the several States and to aid in solving the pro-tection problems as they arise.

Abstracts from Current Scientific Periodicals

In this department of the Scientific American the reader will find brief abstracts from interesting articles published as English extention, and the European scientific publications. The department, in other words, will be a titled of discuss of scientific information gleaned from reputable sources.

The School-Desk Question

THE first and most essential requirement of a school deak and seat is that its dimensions, in general and in detail, shall agree with those of the pupil. The average bodily proportions of school children have been determined by numerous measurements, and are known to the best-informed makers of school furniture, who are in substantial agreement concerning the height of the seat, back, and desk, the width and depth of the seat, and the inclination of the the dosk, so that school officials need no longer trouble their heads with these matters. The question how the desks can best be adapted to the individual needs of pupils of very different absolute dimensions, and of ages ranging from six to eighteen years, has not been decided so unanimously. Universal desks can be recommended only for occasional use in special cases The school must rely on graded desks, and of these the desks of fixed dimensions are preferable to adjustable desks. If adjustable graded desks were used the exchange of individual desks would be unnecessary, but there is little reason to believe that the desks would be adjusted more carefully or correctly than desks of fixed dimensions are now distributed and exchanged in very small schools, however, where the fluctuations in the relative numbers of pupils of various sizes cannot, perhaps, be provided for with desks of fixed dimensions, without keeping on hand a reserve supply of desks of each size, it would be advantageous to substitute adjustable desks, or, better, to employ a limited number of them in conjunction with desks of fixed sizes of the same type of construction.

Dismissing all the foolish schemes, Dr Koppin in



Fig. 1.—The Rettig desk and seat. Movable as a whole on rails and without moving parts.

Umerkau states that the other requirements demanded by hysienic, pedagogic, and economic considerations may be expressed as follows The deak must permit the pupil to maintain a hygienically correct attitude in reading, writing, listening, and all school work; give sufficient room and freedom of movement; afford the most suitable angle of vision; protect the feet from cold and dampness, be easily removable in orfer to permit thorough cleaning of the floor, have all movable parts designed to work without noise or nitury to the pupil, economics floor space; present a good appearance, and, finally, be cheap and durable

This formidable list of theoretical requirements, in conjunction with the now practically decided question of dimensions, has attunised German inventors and manufacturers and led to the development of more than two hundred "systems," arch of which has found, in addition to persons financially interested in its adoption, many disinterested advocates The most successful of these devices are certain swinging seats and hinged, skiling, or swinging deaks. The principals advantage of some of these contrivances was that they facilitated transit between the long benches and deaks that were formerly in vogue, but the obvious objections to the presence of movable parts and the necessity of exchanging deaks gradially left to the adoption of deaks accommodating only two pupils, while the increasing demand for clean floors led to the construction of deaks movable on rollers or sliding on rails, like the Midrib deak (Fig 2), in which the sekt and the deak movable on rollers or sliding on rails, like the Midrib deak (Fig 2), in which the sekt and the deak are connected, not by two lateral sills, as in the older forms, but by a single beam, placed above the east and between the two occupants, and the combined deak and seat stands on four small feet. In accilitating the cleaning of the floor this construction is superior to deaks with alls, but inferior to the Retti deak.

This historical sketch shows that experience has proved—though no proof was needed—that the theo-

retical requirements stated above are not entirely compatible with each other, so that no single construction can satisfy them all. Hence each system must be judged by the algebraic sum of its morits and demorits, but this sum cannot be expressed with mathematical exactness.

Furthermore, the problem is not completely solved, even in theory. One of the open questions relates to the distance between the deak and the back of the



Fig. 2. - Midrib deak and seat with sliding deak top.

seat. Most, though not all, hygienists insist that this distance should be variable; but school authorities, with few exceptions, will have nothing to do with movable parts, and no convincing proof of the orthopedic or hyginic necessity of using movable backs has yet been produced. Of greater hygienic importance is the shape of the back. Theorists had almost united in recommending a shape agreeing with the natural curvature of the erect spine when Schulthess discovered that the concavity of the lower part of the spine is, in children at all events, peculiar to the standing posture. Whether a foot rest is a desirable addition or not is also open to question. These two important points should be decided without delay. In view of these and other controversies, the prac-

In view of these and other controversies, the practical rules for the construction of achood deaks and seats must, for the present, be limited to the following. I. The deak must be designed for not more than two pupils. 2 Each bench must have its own back and must form a constructive whole with the deak in front of it. 3. The distance between the back of the seat and the edge of the deak must be such that the pupil is supported, in an erect and consfortable position, in reading, writing, and hearing bectures. A Movable part, if present, must be few in number and sure, nearly noiseless, and perfectly safe in operation. 5. The deak and seat must either be destitute of sills or easily movable, as a whole, in order to permit through cleaning of the floor.

The second rule is based upon the necessity of exchanging desks in accordance with the fluctuating proportions of large and small pupils in successive classes, and the consequent necessity of making each desk and its east independent of the others. The American or "intermediate" system, and all others in which each desk forms the back of the seat in front of it, are excluded by this rule.

It is not sufficient, however, to furnish a school with the best desks that can be procured. It is also neces-



Fig. 3.—American or intermediate system. Also a example of excessive distance between deak and back of seat.

sary to make sure that the desks are arranged in the best possible manner in regard to illumination and efficiency of school work, and that every pupil always has a desk and seat of a size corresponding with his stature.

International Storm Signals

THE International Mateorological Committee, of the meeting in Berlin in September, agreed, instead outside a local and a second control of the september of the second country in the second paying diagram. The symbols country in the second paying diagram. The symbols country for the second paying diagram is set of the second paying diagram.

made of tarred canvas. The code displayed at English scaports is three feet high by three feet break the base. The signals adopted by the obtainables were proposed by Frof. Moore, Chief of the United States Westler Hursan.

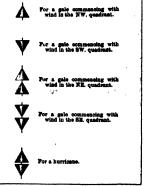
westers futured.

More than a score of different graines of series at make are now used in various piets of the senior to the great confusion of the street of the senior to the great confusion of mariners. However, we senior to do dickel moteorological services describes their own segmain present special advantages, #.3 understood that these may be retained for the beautiful confusion of local shipping, wherever desired, 20.5, aswerting less, graphing to know that as intermational web has boug dicklary adapted, and it appears friting the to use will ultimately become universal.

It should be stated that these new degrands are not

It should be stated that these new signals gay and yet actually used in any country, and the change from the existing signals can only be made gradually; as it will involve great expense. For fastlen, bundreds of signal stations of the United States Wastler Bureau now use, as a storm signal, a red-lag with a black centre, with which red and white pensants are displayed to denote, respectively, canterly and wasterly winds.

The committee was unable to agree on the combinations of lanterns to be used for night sterm signals.



International sterm signals.

and this question has been referred, for further discussion, to the International Commission on Maritime Meteorology and Storm Signals.

The Diet of Athletes and Wrestlers

The W questions have been more hotty diaguted than that of the proper diet of man. Recent investigations indicate that the diet should vary, according to climate, race, and occupation, but Dr. Siebert, who writes in Umachau on the subject, is inclined to go still further, and to assert, as a conclusion drawn from fitteen years' observation of athletes and vracinces, thill every man needs his own peculiar diet. He is obsvinced that psychical infraences play an important part in mutrition.

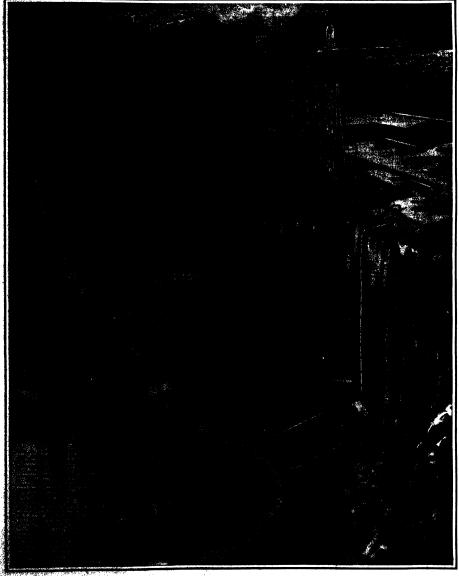
in the constraints of the production introduces part of important part in matrices.

"One of the strongest men I ever knew," Dr. Hebert states, "was the famous wreater Ernet Retter, knewn protessionally as Breat Biggiried. This young man cause to me at the age of twenty, and crimined three months to my exhibit states the sage of twenty, and crimined the months to my exhibit states and his weight 135 pounds. He year-very thin, said life bones were comprisingly happ. He was the same of the contract of the c

The Commercial Utilization of Solar Radiation and Wind Power

in these can be no describing the importance of the problem here discussed, it must be admitted that the difficulties in the way of its solution seem still very great. Whereas problem assesses that water can be raised by the sun's rays to its belling point, the highest temperature so reached which is mentioned in scientific literature within our instances of 65 day. Co. 70 is day 7.

This a well-known fact that practically all the energy of past geo-to the sanks rays. In perticular is that true of coal, the light of the sum. We have found it converted to page 781.



FLANT FOR UTILIZING HOLAR RADIATION AND WIND-POWER ON THE PESSENDEN SYSTEM

The Real Cause of Hoxsey's Death Interesting Speculations Advancing a New Theory

N presenting to our readers a photograph of Archie Hoxsey in his Wright biplane taken just before the machine struck the ground at Los Angeles on December 31st, we wish to give some information on the probable cause of this accident which, as related in our last issue, resulted in the demolishment of the aeroplane and the instant Ceath of the aviator.

photograph shows the machine descending at a very sharp angle in its last dive of 560 feet. Hoxsey descended from a height of over 7,000 feet in less than three minutes, and it is our belief that this rapid descent, which was at first voluntary, caused the aviator to be attacked by a form of mountain sickness such as was experienced by Morane and by Drexel under similar circumstances. This sickness may have caused Hoxegy to become unconscious, and the weight of his body upon the levers may have moved them sufficiently to make the machine dive a much steeper angle until it finally struck the ground.

Hubert Latham, the well-known pilot of the An toinette monoplane, is of the opinion that the mountain sickness just described was the cause of Hoxsey's death Morane told Latham that when he was stricken by an attack of this illness as a result of making too rapid a descent, he lost control of his machine com-

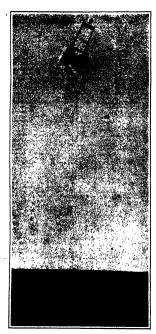
pletely and was saved only by a miracle

The sickness consists of a nauseated feeling accompanied by a swimming sensation in the head and, verhaus, a lapse into unconsciousness The turning of sharp circles while descending, such as was Hoxsey's wont, would also have a tendency to cause a swimming of the head and dizziness. Orville Wright has been troubled with such dizziness as a result of making numerous short turns such as Johnstone and Hoxsey were accustomed to execute

Prof R Moulinier a short time ago made an interesting report on the increase in blood pressure of aviators after seending to heights of 1,200 to 2,000 meters (3,937 to 5,561 feet). The blood pressure is invariably increased during such a flight and there is often a slight headache, together with a tendence to sleep, experienced sometimes even during the flight. In one instance before a flight the constant blood pressure in the radial artery of an aviator was found to be 9 centimeters (354 inches) of mercury and the maximum pressure 18 centimeters (708 inches) as measured on a Pachon sphygmometer, the pulse was 70 After a twenty-five-minute flight, during which, at the twentieth minute, a height of 1,100 meters (3,609 feet) was reached, the constant pressure was 12 centimeters (4.72 inches) of mercury and the maximum 19 (7.48 inches); the pulse had risen The aviators in this case were athletes in full training The rise in pressure was less marked in aviators who were fatigued, but these showed palpitation of the heart and marked acceleration of the pulse (108). In one case of an aviator who, during a flight of an hour, had reached a height of 1,000 meters, tachycardia was manifested This heart trouble it caused by functional insufficiency of the heart and vertiginous movements. No rise in blood pressure was noted in aviators who flew at low allitudes not exceeding 500 feet. The cause of the rise in blood pressure, according to Prof. Moulinier, was probably due to the sudden descent to earth in four or five minutes from heights of from 1,000 to 2,000 meters (3,280 to 6,560 feet) or, in other words, in one-fourth or one-fifth the time required in ascending. At 2,000 meters elevation the atmospheric pressure is 591 millimeters (233 inches) of mercury as against 760 millimeters (299 inches) at sea level. The cir-

culatory system does not have time to become adapte to the change of pressure when a swift de made. Prof. Moulinier also calls attention to the danmade. From Moduliner also can be attended to the designerous fattique of the circulatory apparatus caused by high flying, which provokes increased and irregular activity of the heart especially. A sound heart and supple arteries are absolutely necessary if high flying is to be indulged in.

While it is generally conceded that safety lies in



Hoxsey plunging to his death at Los Angeles. THE REAL CAUSE OF HOXSEY'S DEATH

height because, in case of an accident, the aviator has time in which to again get control of his machine, the fact remains that a sudden plungs from a height of thousand feet is liable to strike the avia helpless if not unconscious, and therefore to seal his death of Maloney in California in 1905. This This pioneer aviator fell several thousand feet in the Montgomery glider, and an examination of his body showed no broken bones or bruises sufficient to have caused death. The doctors gave it as their opinion that Maloney was stricken with heart failure and

died during his descent, white

means as swift as that of Hotsey.

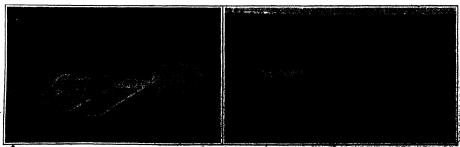
The lesson to be feared from the destance and Housey, both of whom sell as in that inventure should strive to perfect the strip of the stri tem of automatic stability that will make sible for an aeroplane to dive to earth at a de sible for an aeroplane to five to earth at a danigerous angle should anything go wrong about the mackine, or should the aviator become stricken walle in tight. Funding this each aviator who intends to do high firing should carry a paractute, or wear a parachute garment such as west litustrated in a recent issue of the SCHEVILLY ALMERICA, SO that in case, the semplane became unmanageable he could jump or tumble out and deceand to earth in safety. Where the machine is not flown higher than 250 feet, if, is best to be strapped in, as in flying near the growing the trouble is liable to come from collisions by should five from with the aviator stands a better histories. dives from which the aviator stands a better class of emerging uninjured if he cannot be funer out will the crash comes, or even before, as was Motiont of December 31st near New Orleans. In a much work smash at Belmont Park he was uninjured, while at New Orleans he was killed by being pitched out of the machine and falling only 40 or 50 feet.

Automobiles for Transporting Airship Guns

OUR two illustrations at the bottom of this page ahow a new automobile especially constructed for the rapid transportation of one of the new guas lately brought out by the Krupp firm for abooting at airships. Besides aiming the gun vertically, it has en found necessary to transport it quickly from point to point, in order to locate it in a favorable position for attack upon serial craft. A special auto-mobile truck having solid tires and armored disk wheels in front has been devised for this purpose. Special folding skids make it possible to run the gun up on the auto truck in the manner shown. skids then fold over the wheels and are locked into place. The gun is thus firmly mounted upon the autopoblie, which can be driven to the desired point of The auto truck used is a powerful one. It has twin solid tires in the rear, in order to accommodate the heavy gun. There is also a triangular run ning gear below the main frame of the truck. On account of its powerful motor, this truck can be driven across open country and over the worst of roads. On a good road it can make fairly rapid speed.

The Krupp airship guns have been illustrated and described heretofore in both the SCHENTIFIC AMERICAN and the SUPPLEMENT. We refer our readers to these earlier articles for a complete description of the guns and their uses.

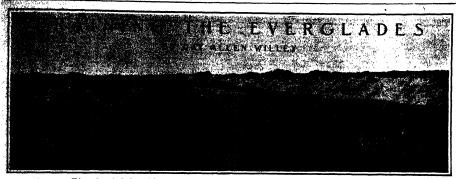
The Canadian Minister of Railways rec nounced that the construction of the Hudson Bay Railway will be begun by the Government at once. The first work that will be given out is the bridge that is nrst work that will be given out is the pringe that is really the beginning of the road, which is to start from the Pas Mission, to which point the Canadian Northern has already built. It is not yet decided whether the mouth of the Nelson or the Churchill will be the northern terminus of the road, and a steamer carrying a location party will be sent north this sum-mer to make a choice of the terminal point. In the mer to make a cnotee of the terminal point. In the meantime the construction of 160 miles of the road can be pushed on, irrespective of the terminus. It is believed that the road will lead to the development of valuable iron pre deposits in a part of the country traversed.



The cannon about to be rolled up the skids to the aut

on mounted on the suite

The second s



This canal was dredged out of the coral rock forming the cup-shaped barrier which keeps the water within the Everglades.

A LTHOUGH the efforts to reclaim the Everglades of Florida have been in progress only about four years, nearly 15,000 areas of what was formerly submerged land, partly covered with sea grass and other water growth, have been drained and over 12,000 acres of it utilised for the cultivatiga of fruit, vegetables and other staple tarm products including sugar cane. The location and extent of the reclaimed territory prove the theory of drainage experts that the water upon a very large area of the Everglades can be removed from it by the present system employed. This area of South Florida is at sich an sittude above the sea level that the current created through out-flow canals will be sufficient to carry away the water which prevents fully 400,000 one of what is now wante land from being productive; athough, as shown by soil analysis, the products of the first 2,000 acres reduced to the control of the control of the sea of the sea of the sea of the control of the sea of the s

verified by the revenue from crop sales.

The Everglades occupy more than half that portion of the State of Florida south of Lake Okeechobee the largest fresh water lake wholly within the United States except Lake Michigan, including fully 5,000 square miles by survey estimate. In this region there lies upon a stratum of coraline limestone an accuition of sand, alluvial deposits and decayed vege table matter. The latter is of such thickness that the productive soil averages from four to fully ten feet in table matter. depth. Upon the muck rests a sheet of water, the depth varying with the conformation of the bottom, which is very rough and irregular. It is largely the overflow of the lake and the entire problem of rem ing it rests in some method of lowering the lake s thus preventing its flooding the land surface. The depth of water over the Everglades has been measured. ured at various points and in different seasons of rain fall. The result of the measurements show that the maximum depth at any time is about three feet, and this has given the experts an idea of the size of the drainage canals to keep Lake Okeechobee at a height where it cannot overflow. The mass of vegetation covering the Everglades is an indication of tility of the soil, the surface water being hidden in many places by grass that grows from eight to ten feet above it. It has a serrated edge and hence it ob-tains its name of "saw-grass" In many portions of the Everglades the saw-grass is so thick as to be penetrable; but it is intersected by numerous and tortuous channels, that form a kind of labyrinth where outlets present themselves in every direction, termin ting, however, at long or short distances in impen-table barriers of grass. In considering the profilem of drainage, the ques-

In considering the profilem of drainage, the question of the slevation of the Everglades has been of great importages and numerous investigations have been made asid measuredesing, lation. The opinion of geologists is that this protion of Florida has been forced upward at least, twice in the world's history by subterranean movements, thus forming a plateau, the bottern geologists, unriving upward with a rim completely possessing as a profile of the contract of consiste Handerica, and another the creater of the rim designation of the creater of the rim to vary in health, above the level runs I feet at high tide to II

when the most practical the most practical the for extra the paperal designs would be received for excessful the reck formation, also works from the paper of the paperal to the paperal t

Wright, Supervising Drainage Engineer of the United States Government, was as follows: To construct one canal from New River to Lake Okcechobse, a distance of 55 miles; one to the west from Lake Okcechobse opening the Caloosabatchee River, a distance of 35 miles; one to the east from the southeast end of the lake, around the ridge to the St. Luck River, a distance of 35 miles, making in the total a system of main canals of 113 miles, each at least 80 feet wide by ten canals of 113 miles, each at least 80 feet wide by ten feet deep. In his estimate Captain Rosee provided for three miles of rock at the head of each canal to be excavated at a cost of the centage free wide of 25,000 each, 100, 104 miles of muck cutting at 2½ cents or 35,000 each, 100, 104 miles of muck cutting at 2½ cents or 35,000 each, 102,000, four modern dredges at \$50,000 each, 102,000, 104 miles of muck cutting at 2½ cents or \$5,000 each, 102,000, 104 miles of the control of the control of the control of \$100,000 captain Rosee Engine that \$1,000,000 captain Rosee Engine that \$1,000,000 captain Rosee Engine estimates as to cost, for experience has shown the actual cost of removing the colock to be \$515 cents per cubic yard and \$46 for the

The dredges used in rock excavation have been of the dipper type. The showle buckets are provided with heavy steel teeth for breaking up the rock, and they work so rapidly that the largest has a capacity for removing nearly 3,000 cubic yards of material every ten hours. The first two completed began operation at the head of what is railed the New River, about 20 miles from the city of Munni. The New River about 20 miles from the city of Munni. The New River about 30 ferons in the real of the second fired that the second fired the second fired that and has a depth ranging from 12 feet to 15 feet. So far nearly five miles of each canal have been completed, but the work is proceeding much more rapidly at present, as any excavators are now in service—As stated, the fund objective point of all these canals is the south edge of Lake Okeechobee When its surface has been lowered 5 or 6 feet it will draw in the water from the surface of the Everglades and this will create continual drainage from the swamp. It is should be devened necessary its surface can be lowered 10 or 12 feet. The engineers will also cut a number of lateral examination these will be intended and in the second of the continuation of the swamp within a few mututes and it is thought that when the impounded water is drained off the land will take care of the natural precluitation.

The Board of Drainage Commissioners was created at Oor. Reveard's suggestion by the legislature of 1908, with power to lay out drainage districts and to levy drainage tax of not more than ton cents per acre each year upon all the lands lying within such districts. In pursuance of this act a drainage district aciding the Evergisles was laid out and a tax of five cents an acre was levied upon all the lands within it. This was opposed in the court by several large land owners, also railway companies, but snother act by the last was sustained by decision of the United States (Creuil Court of Appeals in 1907. This decision means that the Trustees of the Internal Improvement fund have the Immediate cooperation of the Board of Drainage Commissioners, and all funds from the appeals in general variable for the expense of the work. This special

screage tax segregates more than \$200,000 per annum. To provide a complete drainage system will necessitate the construction of about 600 miles of outlets. Most of this work, however, will be merely must exact the vork, however, will be merely must exact the view of the provided with canals which will connect with tidal rivers like the New River, and the success she tidal rivers like the New River, and the success she

tained warrants the undertaking. As the channels are dug the surface water in the vicinity, finds its way into them and flows eastward. The soil of the Everglades is rich, not only in isolated places, but unliften formly rich, as is shown by the many analyses made of it. These show that the percentage of nitrogen in the earth is over 221 per cent, which is a very large proportion of this powerful fertilizing element, but it has accumulated during the long period in which was a communitied during the long period in which was the contraction of the special contains that yellow the case of the contraction of this powerful for nitrogen it is exicultated by the chemiat that each ton of this soil contains fully 36 worth.

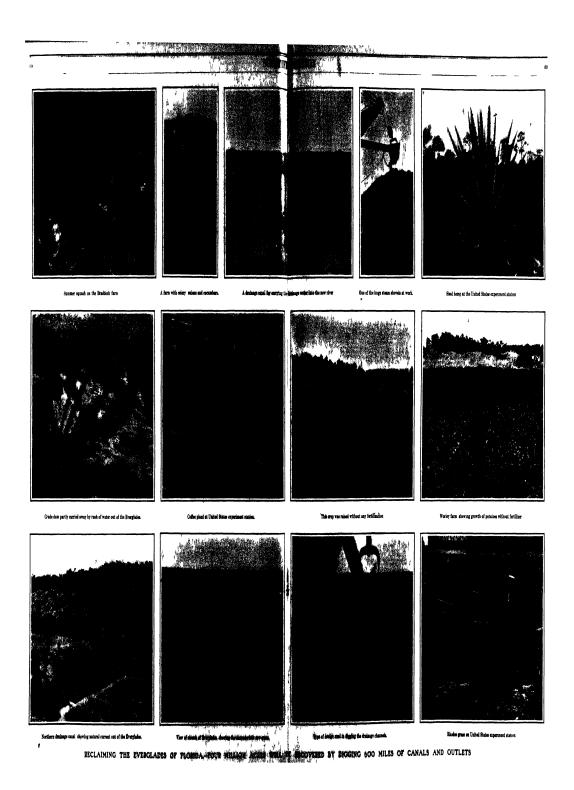
With land of this fertility, favored by the climats, the Evergadacs, where drained, are being occupied by farm settlers from many other pasts of the country. Every kind of trull and vegetative raised in the temperate zone can be cultivated at a profit, to which may be added ornuges, hannans, pine apples and other varieties of tropical tree and bush products. The farms under cultivative since the reclamation work afforded land for the purpose, prove this to be true. This land is being sold in large tracts by the State authorities at \$20 an acre to be divided into truck and other farms by large corporations that wheelen organized in various cities, but the possibilities for producing sugar are purhaps the most important in connection with this great reclamation scheme.

It is the opinion of flow Broward and many other experts who have carefully studied the situation, that the growing of sugar cane and the manufacture of magar will eventually be the chlef industry Louisians produces more cane sugar than all the other states combined, and is known for its production and quality. The average yield per acre in that state is worstly the cone of cane, and the average available sugar content of that cane is seven per cent. The average cane production of the Everglades accretained by striking an average on 420 acres for several years, is \$5 tons of cane per acre and the average available sugar content accretained in the same way is eight per cent. The addition to the soil of potash and phosphoric acid does not materially increase the gross the available "content". In the Everglades connage or this yield, but if does very meterially increase the available "content" in the Everglades connage or the available "content" in the Everglades of the production would be supply the average available sugar content of sight the area waster range and should yield \$5 tone per acre with an average available sugar content of sight per cent to total annual production would be a little more than seven million tone, or conque to supply the demand of the United States for more than two wasts.

osmand of the United States for more than two years.

All fold the American sugar production averages
annually about 560,000 tons. To meet the consumption 225,000 tons are imported Consequently the
Everglades clone could produce about three times as
much yearly as the country needs and about fourteen
times our present annual output.

Statistical inquiries by the Department of Agriculture have been made in regard to the prices of beef and pork, to assertain the difference between wholesale and retail costs: A study of the marketing and transporting of grain in the region of the Great Lakes dealt with the reduction in the cost of marketing and the increased quantities handled during the last quarter century. An examination of the cost of selling and delivering grain and live stock in the Paulic coast states was begun. Wages of farm labor were further studied, including cost of living as compared with that of city employees. A study of dates of planting and harvesting crops throughout the world





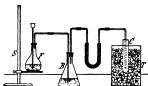
of the Home Laboratory will be glad to receive any his department and will nav for tham, promptly

The Liquefaction of Nitric Oxide By Robert H. Bowen

Probably every amateur delver into the stores of science has heard of liquefied air and the phenomena of liquefied gases. Few, however, are aware of the fact that liquefying may be done at home on a small scale, very cheaply, provided that the proper gases for such treatment be selected. In the following experi-ment no abnormal pressure is required as in the case most gases, and simple cold suffices to condense the gas, which will be nitric oxide.

The apparatus for preparing and "freezing" the gas is shown conventionally in the accompanying figure. I' is a small flask of about 250 cubic centimeters capacity, supported for safety and convenience on the ring riand s. The flask is provided with a two-hole rub-ber stopper, through which passes a thight tube and a small angle piece of glass tubing. The angle piece is connected by a piece of rubber tubing to a glass tube, the opposite end of which is immersed in the water contained in the bottle B. Another short tube leads to a U tube filled with granulated calcium chloride. The connects with the test tube C by means glass tube and a short section of rubber tubing. The test tube is contained in the can T

To perform the experiment, place in F about I owner of copper turnings or short lengths of copper magnet wire, and fix the stopper tightly in place. Fill the bottle B with water, the level of which should be somewhat above the end of the long tube. Stopper Btightly, and connect by means of the short angl to the drying tube. Pack the test tube in a mixture of



ice and ammonium chloride (sal ammoniac) afte the manner of filling an ice cream freezer care being taken that no water is allowed to enter the test tube All is now ready to commence. Pour slowly into the thistle tube enough nitric acid to seal its end. Action at once occurs with the copper, and brownish fumes fill the flask. The gas as originally generated is really colorless, and is called nitric oxide (NO). On coming into contact with the air, the gas at once oxidizes, taking on a brownish hue, and becomes nitrogen peroxide (NO.). When sufficient pressure is obtained, the gas bubbles up through the water in bottle B, and passes thence through the calcium chloride tube, at length arriving in the test tube, which is contained in the freezing mixture. Here the gas is condensed into a fluid, the color of which, if perfectly pure, would be like that of water However, it will probably have a slight bluish tint. Unlike water, the fluid will not solidify, which water would speedly do if subjected to the same conditions

The quantity of liquid thus obtained is very small. and experimentation with it is rather restricted. experiment may be tried with only a single drop of the fluid gas Remove the test tube from the freezing mix-ture, and warm the bulb with the hand. The fluid vaporizes slowly, and the customary brown fumes ap-Now seal the open end of the tube with the thumb, and replace in the freezing compartment. The gas is speedily recondensed, and forms a partial vacuum in the tube by the decrease of its volume.

This is made evident by the sucking effect which is exercised on the flesh of the thumb. The brownish fumes disappear simultaneously.

Should the action in the generating flask slacken, it may be accelerated by the addition of more ritric acid. The wash bottle and calcium chloride tube may bedlispensed with if they are not contained in the ama teur's laboratory, but it is advisable to use them. large tin can serves very well for a container for the

ice, and should be wrapped outside with several thick nesses of newspaper to reduce the radiation consequent from the large surface of metal which the can presents. I do not lay any claim whatever for originality experiment, but as it is quite unique and articles on this subject are very rare, I thought it worth while to make the legion of amateur scientists acquainted with it.

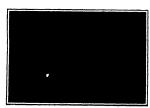
A Unique Wind Vane and Electric Indicator By Frank C. Perkins

The wind vane pictured herewith is connected electrically to an instrument at a considerable distance



Weather vane electrically connected to indoor indicator.

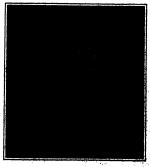
which indicates, by means of a magnetic needle, the direction of the wind. This apparatus is of value to an observer situated where he cannot see the vane from a window, and especially at night, when the direction of the wind is difficult to determine. The vane is made as light as possible, and in such propor-tions that it will balance nicely on the bearings, which onsist of the head of a worn-out bicycle The vane is held in place by means of a 1/2-inch iron pipe, which extends down into the head. The clamp formerly used



Indicator for the weather vane

to secure the handle bar will hold the vane in place. In place of the forks is attached an eight-cylinder automobile timer, slightly sitered in such a manner that the brush is always in contact, and when pointing between two contacts, connects them both.

The indicator consists of eight 4-ohm magnets arranged 45 degrees apart in a circle on an inch board, with their faces pointing toward the center. These can be obtained from any electrical store in pairs, and are termed instrument magnets. They are held in place by small angle brackets, as can be seen in one



The indicator dissected.

or the enginerings. Covering these is a thin he which is thataned a healty drawn that term marker's coupass card. The cover is easily me a picture frame, with four small bords arra take the place of the picture as shown. The is wn. The ladi needle is a simple magnetic needle balanced on a pivot over the dial. Around the indicating end of the needle, which is painted black, is wound a fine wire, the end of which extends down to about 1/82 inch of the dial.

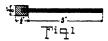
There are eight wires, which connect the outside wires of each of the magnets to a contact of the timer. The inside wires of the magnets are compected to the The inside wires of the magnets are connected to the iron brace which supports the magnets. The braces are connected to each other by a ground wire, and in series with a push button and two or three dry cells of hattery with the time brush. The timer should be fastened in such a position that when the vane is pointing north, the brush will make a connection di-rectly in the center of a contact. The contacts and nagnets are connected in such manner that when the wane is pointing in a certain direction it will connect the batteries with the magnet under the dial, repre-senting the direction from which the wind is blow-

It will be seen that when the vane is pointing in such a direction that two of the contacts are con-nected, two magnets will be magnetized and the indicating needle will point midway between two lines on the dial, thus giving 16 directions. The magnets under the disl, when magnetised, will attract the needle and, on account of the "dip" caused, will bring the end of the fine wire in contact with the dial, thus preventing the needle from swinging a few moments before coming to a standstill,

It may be mentioned that by using a closed circuit battery and not using a push button, the needle will at all times indicate the direction of the wind, and can be read at a distance without requiring the ob-server to go close to the instrument to push the button, as is the case when dry cells are used.

A Self-cooled Spark Gap By George F. White

Wireless experimenters possessing 4. kilowatt capacity or more, often experience diffi-culty in making their spark work properly after the electrodes have once heated up. This trouble is par-tially eliminated if transformers are used that are wound for a high voltage. The higher the voltage



the greater the pressure, and the more easily the secondary discharge will leap a given distance. A 260-watt transformer, if wound for a secondary discharge of 8,000 or 10,000 volts, will leap a gap hardly more 5.000 or 1,0000 voice, will leap a gap hardly more than 0.25 or 0.25 of an inch, while one of the same wattags, but with the secondary wound to 15,000 voits, will easily leap a space of 0.35 or 0.45 of an inch and even more. Of course, the amperage in the former than in the latter, owing to the measury increase of resistance of the latter because of the secondary increase. e of the extra turns necessary to bring the voltage up.

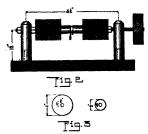
It can be seen by the comparison of spark lengths that a transformer of low secondary voltage will necessarily use a shorter spark for transmitting than the one of higher voltage. When the el than the one of higher voltage, when the electrodes of the oscillator or gap begins heated, the spark becomes weaker and neede shortsoning. In the transcorrect of higher voltage this is not always necessary, as the greater pressure can unually maintain a regular spark. However, the lower voltage transformers are being used almost universally, on no count of the thigher superage and subsequent radiating and penetrating qualities of the discharge. As mark maintained between cool electrodes has a etrodes ing and penetrating qualities of the discharge. A spark inshinkland between cool electrodes has a higher frequency per second blass one between heated ones, and heree a greater resistative power. Hence ones, and heree a greater resistative power. Hence ones, and heree a resistant per Hence it is evident-that some method must be used to keep it is evident-that some method must be used to keep possible, the slactivess of the discharger as sools as possible, to ourganeant the use of the lower vottage. There are several methods in use how that are very regentous. One consists in Moving a current of cool- air feerfeity means the attackers matchine in the new for-resistant. One consisted in blowing a current of cools at Parcisity, upon the sectoriose; machine; in the use of redistrys. To displain the best results with the former meltind, the spin phesicide in include it is a small sightly case, at the beston of which a rubber table should either. This school and to are electric into. The current of air produced by the fair is collected by means of a large checkmand funnal, the small use of which farming the collected in the cubber cube. At the key of the gap applies such thus though start to the value of the gap checkman of their though start to the value of the gap checkman of the start of the spin of the gap checkman of the should start the start of the spin of the gap checkman of the spin of the spin of the gap checkman over the gardines that the should start to the value of the spin of th

also the heated atr. The other type of cooled gap, and the one from which this article derives its stift, is of the saircooled type. It is more destrable even the anatour's standpoint than the other method, being cheaper and comparatively easy to

mary 25, 1911

For the electrodes, sinc pencils having a %-inch face can be used. They should each be ½-inch in length and tapped for a 10-24 screw 3 inches long.

A %-inch surface will be ample for discharges up to 1 kilowatt. Larger sizes are necessary for greater capacities. The radiators are made in the form of



The assembled self-cooled spark gap and a disk and

washers I firch in diameter of No. 20 sheet zinc [Fig. 3). The shot at the center should be a trife larger than [4,inch, to allow the radiators to slip over the 823 threads. It can be made with a center punch, and the rough points on one side of the disk (caused by punching) illed away. There will be twenty punching illed away. There will be twenty of the side of the disks needed for each electrode. They should be atternated by small copper washers for spacing (Fig. 1). When the disks are in place they should

be clamped securely with a 10-24 nut. Binding posts made of hexagonal or round brass are necessary to support the gap electrodes (Fig 2). They can be mounted on either rubber, fiber, or marble. The electrodes are threaded into the posts, one being made fast with a nut while the other has a knurled rubber handle for adjusting purposes.

The two posts are made fast by means of screws that pass up into them from countersunk holes in

A Mirror Illusion

By Prof. Gustave Michaud, Costa Rica State College

By 1702. General antenname, Costs and cases designed with the accompanying figure. The best way (not the only was however, as we shall see further) to get this fillusion is to place the figure on the edge of a table, near a window, and to look at it with a sterescope brought at the required distance, the projecting rod of the instrument being thus kept outside of the table. Be-

sides the ordinary steroscopic roller, another phenomena appears which gives the sterogram a most extraordinary aspect. The mirror assumes a thoroughly metallic surface, just as if a sheet of highly polished silver had been glued over the paper. As to the books, they are not seen upon the metallic surface, but behind it, exactly as if their image were reflected by the mirror.

Meer no actrooccepe is at hand, most people will give the same lilitation by making in a sheet of black pasteboard two holes about 5, of the land in diameter and casal: 3/4 inches apart, distance about 5, of the land in diameter and casal: 3/4 inches apart, distance about 5, of the land of the

-bare to examine, the optical axis of the eyes, in most cases, becomes parallel; the two holes get nearer, and finally mores into one single hole, through which the Station is obtained with as much intensity as

the streets a streets of the street of the streets of the streets

and apparently pollshed, opaque surfaces which are not metallic diffuse light in every direction, and send about as much of it to one eye as to the other Highly pollshed metallic surfaces, on the contrary, redect only in one direction the light which comes to them, if a small part of the reflecting surface be considered. When our eyes are close to such surfaces, it often occurs that one eye as in the direction of the reflected light, while thoe ther is not. One eye sees light where the other sees none. We have then what may be called the metallic visual sensation. This sensation is, of course, entirely subjective, and, just as the sensation of light may be produced without light, the metallic visual sensation may be produced without metal, through the artifuse just described

A Freak Barometer

By Albert Alexander Somerville, Ph.D.

It is a well-known fact that a plant receives water at its roots and loses the same at its leaves by what is called transpiration. The subject is of much interest to plant physiologists in accounting for the means of transit of such a great quantity of water as is known must be conveyed through the trunk of a tree.

If the leaves of a plant are partly witted after a hot day, it is probably because more water has passed from them by evaporation than they have received, by morning however they are again rigid, which is evidence that during the night enough water has been conveyed to them to account for this excessive loss of the previous day.

Experiments show that the amount of water drawn by a plant is much greater than one would ordinarily expect; also when one considers the height to which it must be raised in some of the tallest trees, it is seen that the work done in a forest is easily more than

seen that the work done in a forest is easily more than equal to that of a city water works department. The ordinary way of beginning the problem is to consider that the water is pushed up from the bottom; this is done by what is termed root pressure or bleeding pressure.

Another method of producing unequal pressures is by osmosis, or semi-permeable membranes consisting of porous materials which will allow a certain solution to pass one way only, and thereby increase percentage of solution on one side and decrease it on the

Noither of these however will lift water to any great height, and even if we add to them the height water may be raised due to atmospheric pressure, it is still

far short of the total height of most trees.

Then if we have used all the means known to produce a "push" at the bottom, it is only natural to consider what we can find at the top in the way of a "pull"

The first of the phenomena we consider is that of capillarity The laws of physics are that the height to which a liquid will rise in a capillary tube is directly proportional to the surface tension of the liquid in contact with the tube, the angle it makes with the tube, and inversely as the size of the capillary. Well, this latter being the case theoretically, it is only necessary to make the capillary small enough, and water can be raised to any height desired. This

Since the amount that does reach the top is very great, another force is probably in use. The water may first reach the top through small capillaries and spread through the woody fibers, becoming attached to these by the force of adhesion, and then support a column due partly to the cohesion of water particles.

An experiment tending to prove this is described by Askenasy, and has been performed by the writer in



A freak barometer.

his research laboratory simply for the pleasure of seeing the same in operation. The accompanying photograph is of the same, which is described herewith

If a gizze tube open at both ends has one end wellclosed with a block of gypsum or plaster of Paris, this block so long as saturated with water vapor is almost wholly impervious to the passage of sir. The tube is filled with water, inverted, and placed open end down in a vessel of mercury as an ordinary mercury barometer. The air should be boiled from the water. The water then evaporates from the top of the plaster of Paris pluz, and the water from below follows through, drawing the mercury column up after it, due to atmospheric pressure.

After the ordinary barometric height is reached, the mercury column continues to ascend, probably due to the adhesion of water and mercury, cohesion of mercury, cohesion of water, and adhesion of water and plaster of Paria

The apparatus was constructed by drawing down a large tube at one end and scaling it on to a smaller tube shout 125 centimeters long Diameter of tube. A millimeters; length of planet of Paris plug, 3 centimeters; length of planet of Paris plug, 3 centimeters. The experiment was started October 26th, 1910, at 8 A. M. and the following table shows the rate at which the water passed through the porous plug:

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		- 4



Place this is a stereoscope and note the mirror illusion.

may be all true enough, but there is another law yet to be considered, should be in, that the amount of liquid that will flow through a capillary is inversely as about the fourth power of the diameter of the tube. Now if the tube is assist enough to lift water to any considerable height, it is so small that scarcely any water will flow through it, and so the amount lifted to the top will be very small indeed.

	Time	Height of Mercur Inches
Oct	26 8 A M	0
	27- 8 A M-1 day	6.5
	28 8 A M 2 days	9.
	29- 8 A M -3 days	13
	30 8 A M 4 days	173
	31 - 8 A M - 5 days	25
Nov	1 - A A M 6 days	33
	1-11 A M	35

The picture was taken at this time, and the scale shown is a meter stick ruled in inches on one side, and not a yard stick as might be supposed

During the second, third, and fourth days the humidity was very high, no that evaporation was slow During the fifth and sixth days a test tube containing calcium choirde was inverted over the top to absorb moisture and so hasten evaporation. The difficulty is that some air will pass through the top, and thereby cause the column of water to break loose at the top, but nevertheless it holds long

enough to prove the point, and earns the title of the freak barometer.

A patent was recently granted to a Schenectady man for a golf club provided with a tubular nonfibrous shaft; or, more specifically defined, a shaft of steel tubing.

The Man-machine

(Continued from page 60.)

ability to contract muscles, since ordinary muscular contractions at very low tem-

peratures are impossible. Laboratory experimentation has she the essential nature of this chemical process, and its relation to fatigue. The great storehouse of glycogen (muscle sugar) is the liver, which organ takes it from the alimentary tract and supplies it through the blood to the muscles, as their smaller stores are used up. A muscle be ing stimulated to contract, there is a reaction between the oxygen of the blood and the glycogen; and the result is the formation of waste products and a release of energy, part of which latter contracts the muscle, while the rest in the form of heat is either wasted or used to main-

e bodily temperature. Fatigue is usually attributable to waste products formed in the reaction just stated if the extract of a fatigued muscle be injected into animals, great languor and prostration result, with indi-cations of fatigue To inject extract of non-fatigued muscle has no effect at all A fatigued muscle is one in which by reason of repeated contraction, there has been much chemical change—with the accumulation of waste products. Thus soldiers, after an exhausting march, are

The fact that the workman who does not rest gradually loses his energy should certainly be a most vital matter for em-ployers of labor to consider, if not from the humanitarian, at least from the eco-nomic and purely Gradgrind viewpoint

We have now an American Museum of Safety, established in the Engineering Societies' Building in New York city, here one finds many inventions and contriv-ances for the preservation of human life. It is the fourteenth of its kind in the world; but the first in the United States There are a dozen such museums in Europe, where the subject has long interested social scientists and those who make tion has been reduced to a system; and the number of industrial accidents has

been reduced 50 per cent

But the best surety against accident is an alert mind in a virile body, and on the other hand, the ideal predisposition to accident is an exhausted, rundown, de vitalized human machine There is now no question of the reality of the relation between fatigue and accidents: in Europe this has been scientifically noted for practically all forms of human activity. Bank clerks make most of their mistakes in the late afternoon, and this appears to be one of the reasons for the comparatively early closing of such institutions, since the bankers have found their employees' mistakes to be expensive. Everyone now knows that dire calamity results when allway men work continuously too many People should understand also hours. that physicians are not to be overworked, and that rather than this, substitutes or assistants had best be willingly accepted; men who have in their charge the keeping of human health (the most precious thing in existence) must be vouchsafed normal minds in normal bodies. The part-time minds in normal bodies. The part-time method of school attendance of children as I doubt not, oftentimes unavoidable. Still I thus discelluntance, and of these by no means the least is that in the after-noons the minds of children are unfairly taxed, as when they are made to grapple with such difficult subjects as mathe-matics, which should be a morning subject. when the minds of children are clear and

One here perceives the best of all arguments from whatever viewpoint one chooses for the eight-hour day for all forms of labor. For some kinds of labor even eight hours is much too long. It is melancholy to observe that for many employers the prevention of fatigue accidents can be brought about only by making them very expensive A wise corporation, however selfish, will here instinctively

reduce its hours of labor; for reeconomy, if for no other. After all it is gratifying to note that the essential parallelism of efficiency and humanity is being increasingly appreciated through civilization.

Our Smokeless Cannon Pow der the Best (Continued from page 63.)

specifically mentioned the use of grease and oil, to render the material less sen-sitive and less likely to be detonated accidentally.

The following, quoted from Sir Hiram Maxim's letter to me, dated August 8th, 1889, proves what his opinion was at the time of writing it "There is nothing new about the addition of nitrogly. cerin to a solution of guncotton. It was patented fifteen years ago by Nobel." Even the use of castor oil by Sir Hiram Maxim was based on an erroneous as sumption. It was thought by him that amprion it was thought by him that any colloid of guncotton or colloidal com-pound of nitroglycerin and guncotton, both ingredients being high explosives, must necessarily be a detonative compound, requiring some sort of deterrent to adapt it to use in guns Experience has proven that no such deterrent is required; for the dense, horny, tenacious character of the material itself abso lutely obviates any danger of detonation whether the colloid be made of pure nitrocellulose or of any compound of ni trocellulose and nitroglycerin up to 60 per cent of nitroglycerin to 40 per cent or nitrocellulose.

As Sir Hiram Maxim never used ove 25 per cent of nitroglycerin in any of the laboratory samples made by him and seldom employed more than 5 per cent, it is easy to see how little importance should be attached to his cas tor oil patent Even the use of castor oil by Sir Hiram Maxim in smokeless powder was suggested to him by me. I learned from Prof Fowbray, who was at the time connected with the Xylonite and described and the second in the time connected with the Armondo human welfare their earnest concern in Gompany of North Adams, Mass., that they had experimented with the use of castor oil in their xylonite or celluloid; but it did not work well, and was consequently discarded.

In view of all the foregoing facts, it does seem a little impertinent that a man of Sir Hiram Maxim's very limited experience in explosive compounds. ignorance of their nature and use should write letters to our Chiefs of Ordnance and to our President, that our smoke less powder is all wrong and that our government officers who are responsible for the adoption of its form, and who have developed the material of which it is made, do not understand their busi-ness and should, metaphorically speaking, be hauled over the coals and set

Had it not been for the world-wide reputation attained by Sir Hiram Maxim due to his invention of the automatic and the honor conferred on him by the English crown by knighting him his letters to our Bureau of Ordnanou and his letter to the President would have received no attention whatenever and the matter would never have becom public

In 1895 I had a contract with Hiram In 1895 I had a contract with Hiram Maxim, by which he was to receive a certain commission on any sale of the Maxim-Schüpphaus smokeless powder patent rights, which might be effected with his co-operation and assistance; and it is interesting to know what his opinion was of the powder and of my multi-perforated grains when that contract was in force. I quote the following from a letter written by him to Lieut. J. F. Meigs, Engineer of Ordnance, Betablem Iron Works, Bethiehem, Pa., dated 32 Victoria Street, London, S. W., August

Victoria Street, Louwes,

"This new form of powder has multiple
perforations If powder is only per(rorated with a single hole, it burns from
the outside and the inside at the same

(Continued on page 78.)

RECEPTLY PATRICTED INVESTED

These columns are open to all pain otions are inserted by special arrang the to the inventors. Terms on application to tising Department of the Screenzers A

Pertaining to Apparel.

HAT FASTENRE,—J. TRUB, Bayense, R.

J. The fastener is more especially designed
for use on ladies hate to fastan the same
securely in position on the head. For this
purpose we is made of ne or more cembe
forming a permanent future on the last, to
readily engage the wearer's hair on placing
the hat in position on the head.

the hat in position on the head.
BELT BUCKLE - J. F. Durn, New York,
N. Y. This invention provides a buckle wherein the grid on the belt is proportioned to
the pulling strain, provides a construction for
the griping number to make the same nore
rigid and to afford guides for the operation
thereof; and provides a buckle which is
simple, effective and durable.

DEVICE FOR DRIVING FISHERS.—C. E. FREER, Sandusky, Ohio. To some extent this invention is in the nature of a subaqueous nierm. More particularly stated, it comprehends a number of buoys to be connected with

invention is in the nature of a evaluation of an alarm. More particularly stated, it comprehens a since or the like, and containing alarms which are centrollable electrically from a predetermed point, in order to frighten the sition or since a definite path.

ELECTRICAL ILLUMINATING SION—W. W. ARMOLD, Hamilton, Ohlo. This invention provides an apparatus for producing illuminated other symbols: provides mans whereby the foregoing object is accomplished through a solution good of the provides a construction whereby the successive trained in illuminated form or obliterated at the operator's will

Of Interest to Parm

Of Interest to Farmers.

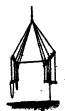
COTTON-CTARANGE.—A. L. A. L.

of churning.

FRUIT PUTKER — A. II BARTIAN, Portland,
Oregon. The alm of the invention is to provide a new and improved fruit picker, arranged
to Issure ready detachment of the fruit from
the tree and to prevent bruising theered during
the act of detaching the fruit and lowering
of the same to the ground for the removal
from the picker.

from the picker.

CHUNN.—W. W. Intras, Mitheral Walls,
Tezas. This invention has reference to improvements in churns and means for driving
the sum, and has for its abject the preduction
whereby the churning operation may be performed to an expeditions manner. It consists
of few parts, the framework being cust in one
pice, and the parts are so arranged that they
can be reddily assembled and disassecuted. can be readily assembled and disassociated. STRAW HOISTING NET:—Genome Glaber. Halleck. Newade. The accompanying engraving illustrates a hoisting not for straw and the like. It comprises two sets of chains secured to the cross bars, which serve as psynaders. One of the cross bars is fitted with plans, on



MPRAW MODERNING WITH

which the chains from the op are hooked. The first cross the to cell up the chains, and hold ing position. The har is knot release the short chains, and hold the me

Simil-Traction by the latest bur of seed named to be time. It also provides at the tractions samples of the tractions sam the creations samples of world in the possibility of confusing the south is entirely etuninated, while it persists to be easily inspected at all the can be marginalized without difficult in placing the seeds in the device, and a beautiful confusion of the confu

in placing the seeds in the davies, and remarking them for inspection.

COUTON PRESS.—A. L. Transm. Jensings, Okin. The insured control into a sheet and the sheet land a roll or hale shaped under a uniform pressure; provides means for delivering from the press the hale when rolled; provides means for associating when the desired pressure is recurred upon the late; and provides means for associating when the desired greatered from the late; and provides means the late of the late; and late of the late of the late; and late of the la

bale automatically.

COMENNO! CUSTON CHOPPER, SCHAR,

ES, AND CULTIVATOR—G. C. Lacens, O.

K., Miss. Among the principal objects which
the present invention has in yiew zer to previde a machine wherein the cotten may be
chopped and the ground cultivated and leveled
in the mans operation; and to provide measure
whereby the operation showe described may be
curried on independently.

Of General Inter

Of General Resources.
HOOF PROTECTION—A. J. Gentley, New York, N. Y. The device comprises relatively movable guard members adapted to be pestioned under the hoof, within the shoc thereon, means for spreading the members obstrately assessed to the property of the period of the perio

EMORINO IMPLEMENT.—J. M. Enras, New York, N. T. The lower-time relates to smoking implements, such as pipes, and edger or elapstoners, and the second of the class, composing a tobacco-holding member. a stom having a mouthpiece and provided with a passage of smothing-time from the tobacco-holding member to the most from the tobacco-holding member to most from the tobacco-holding member of the most from the tobacco-holding members of CERTAIN METALLIC OXIDS.—E. CLATWINGUT, \$2 CLATWINGUT, \$3 CLATWINGUT, \$3

of these cations in a chemically insert medium. PARASOI. RAG.—H. K. HARREN, New York, N. Y. The bag is designed for safety housing a large number of personic and similar articles, such as sumbrellas or canes, in a comparatively ling sides tapering from the bottom to the mostle, and ourside pockets arranged exteriorly of the until has, closed at their lower codes and open at the top, the latter being a distance believe the "south of the mass bag."

below the month of the main bag.

PROLECTIE.—J. F. OFEREM. Contact,
Ner. and T. A. PLOOD, Sair Labe City, Utah,
This invention is in the nature of a projec-tile in the form of a bullet or missile as the
time of the state of the same of the state
catching will be almost, and made of the
to provide a projectile carrying a narcoric
whose anosathoid effect will no affect the animal as to rander the capture and control of
the same many.

morem truck.

APPARATUR FUR PACILITATING WALK.

NG.—W. W. ANUMAND, Holty Reptings. Misc.

NG.—W. W. ANUMAND, Holty Reptings. Misc.

This improvement is to live struchment shaped for facilitating walking or jumping. It is entrodidd in applicance or devices adapted to is escensed to the thigh and foot of the warrey, and an intermediate nonecting portion formed of springs, which are alternately fund and entered in the act of walking.

and extended in the act of welking.

LEVEREMP-LVLKK.—H. R. Harvan, Atward,
Kink. In the present patent the forcesion has
for its purposes the providence of a patient
provided buty to unspended from the one of a
patient of rounter, by the insulan, and which
provided with a viviteelty adjustante verific.

REPOYME OF PRESENTE WHEEL PARTY OF THE PARTY

The weeker operates to swing the sentence of the window casing, at it can the window casing, at it is consider the series of the sentence of t

distribution of the control of the c

METHOD OF PRODUCING STABLE SOCIALLS C E LUULO SE DERIVATIVES FROM VISCOSE—L LILIBURED, VILLES gases 1, Visens, Austria. The utility of this bew product lies not only in its superior sta-ditty (It will round stable for several months at the ordinary temperature of a room or longer if the temperature is lower), but side in the continuation of the control and its solubility in water, whereas the ordi-nary viscose, including zanthepsate or skill cellsion-zanthogrante, possess but little stability.

mary viscoss, including Zanthogorate or sized collections-numberwates, possess but little collections-numbers and the property of the collection of the coll

LIPPING DEVICE.—J. II SPENCES and J. SIEFFON, care Macdonald Engineering Co., Memphia, Fram. The purpose of this invention is to provide means for lifting forms in re-inferced concrete construction, which will indicate the extent of the lift. The device consists of a frame, to which the form is attached, and this frame is provided with gripping means entering the contract of the lift.



Constitution of the second

ranged to part the mold in a radial path to form accurate half molded sections; provides a ring, the halves thereof, when pared, pre-sent the mold firmly for manipulation; and provides a ring with rests whereby it is sup-ported on an operating table.

LETTER SLOT ATTACHMENT.—JOREPH POPENHAUEN, 1842 West Monroe Street, Col. cago, ill. The letter-slot attachment here illustrated is adapted to be applied to a trunk, so that the owner of the trunk, on leaving for a trip, may instruct a suitable person to



LETTER SLOT FOR TRUNKS.

deposit all mell which may come for him during his absence, in the trank, where there will be no danger of its being lost or tampered with The alot opening is provided with a spring, presend guard, which closes automatically and prevents the intrusion of dust or other matter into the trunk

MUSIC TEACHING DEVICE.—O. NELSON Route No 2, Artell, Nebraska This inven-tion provides an improved method of teaching the rudiments of music, particularly transpo-



MUSIC TRACHING DEVICE.

sition, by the use of slides hearing characters denoting the intervals of the gamut or distonic scale, the slides being movable relative to the representation of a keyboard, the keys of which are altered movements of the distortion of which are altered movements bearing the signatures of the different keys, which are adapted to be purcel insultantive critical bearing the signatures of the different keys, which are adapted to be purcel in alternate KFY RING—J. A. Pknous, Ja., 112 Hudson Street, New York. It is quite an advantage to be able to swparts the keys fatt one certification of the company of



One section of the ring may be used for officiency and the other for house low, so that when he was the section of the control of the control of the control of the lower the cuttre set before fluiding the desired one. The lay ring is very simply made, as shown, of a single length of wire, the cude of which are located within the ring where they are not liable to each and tear the poeter. SAW SET—J. C. MINAGALANO, Oklahomas, O

corresponding or the support, to easier a predicted velocity of the concerts considered and the second of the concerts considered and the second of the concerts considered and the second of the seco

HORE-COUPLING.—B. Moncan, Newport, R.

1. The object of the present invention is to protive a coupling which is readily adjustable for
hose of different sizes, and arranged to permit
convenient placing of the coupling in position
and to securely fasten the parts, such as a hose

being provided to facilitate removing and appropriate to facilitate removing and appropriate to facilitate removing and approvides means for holding in guided resistance of the facilitate to a class of the means for the blade of a moving marchine active, provides discovered to make a provides adjustment for varying the operative position of the blade holder strength of the facilitate is and provides adjustment for varying the operative position of the blade holder.

Rardware and Tools.

NUTLICK — L. K. Waynors, Sen Cliff, N. Y. The invention provides and introduced upon a sleeve, and the sleeve in term is mounted upon a hold, and so arranged that in consequence of pressure of the more residily to their parts.

DOR LOCK — A. J. Hillards, Dortland, Orrhals invention is an improvement in door locks and the object is the provision of a lock spectra of the provision of a lock spectra of the parts of the object is the provision of a lock spectra of the provision of a lock spectra of the parts of the object is the provision of a lock spectra of the provision of a lock spectra of the parts of the object is the provision of a lock spectra of the provision of a lock spectra of the parts of the object is the provision of a lock spectra of the provision of the lock of the provision of the lock of the provision of the lock of the provision of the provision of the lock of th

and introduced and the second of the property of the control of the second of the seco

Household Utilities HAND-BUBBER .-- M ANGRET. New York. N Y. This invention pertains to certain improvements in band rubbers for use in washing cioties, and more particularly to that type of subber which presents a roughened under surface and which is adapted to contain the soap or other detergent and to deliver the same to the material being washed

or other delephent and to deliver the anime to the material being washed A.M. Wonstein, A.M. Wolff, and A.M. Wolff, and the state of th

Machines and Mechanical Devices

Machines and Mechanical Devices.
VOTING APPARATUR-W A RASSON
Densities, N. 1 Use is made the investigation of the colored differently as to parties, and adapted to be placed by the voter into a ballot earlier hatting means for reveiting the ballots earlier, after being filled by the voter, is placed on a stand and extincted, so as to drop the ballots into receptacies according to offices to be a standard and extincted, so as to drop the ballots into receptacies according to offices to be a standard and extincted, so as to drop the MININGARGUINE A P. Nuc. Philadech.

he voted for,

MIXING-MACHINE A. P. Nijes, Philadolphia, N. Y. The machine is for use in mixing
concrete and similar material, and the invention relates more particularly to a mixing ma-cline comprising hollow, communicating sec-tions arranged so that they can be revolved, and having an inteit and an outer, partitions being provided within the sections, which serve to direct the material possion through the

VALVE.—J. E. DAYIDSON, 722 Colorade Street Butte, Montana The mechanism illus-trated here still is intended to regulate the extent of opening of a valve, and to hold a valve at this open posttion indefinitely. It



VALVE BYOUT ATOR.

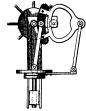
tion with a solenoid. The ratchet wheel is mounted on the valve area, and when the current is admitted to the coil of the solenoid, the core is drawn unward, turning the ratchet the current is cut off. a weight operator in draw the core downward, without, however, closing the valve By repeating this action, the valve may be opened to now degree de-sired.

MEANN FOR ATTACHING SEALS TO PACKING-CARIS- 8 Kruon, 30 Allerten road, Joséabl Park, London Bagiand This irrention provides improved means for attaching packing cases According to the improvement a strip of mutual cut and shaped to form a supply of seals connected together by come a supply of seals connected together by though the device and a connected provided to the provided of the provided provided to the provided provided to the provided provid

seal and a first pin air in position for use, VAININFITING I P. Brawerzen, New York, N. Y. The object here is to provide a fitting for attach most to certain vessels, and arranged to permit convenient filling of the vessel with sater and gas to form a charged lightly to allow transportation of the vessel bright in allow transportation of the vessel of the vessel that the property of the con-tine apparatus of the property of the vessel with sater and gas with-out removing the fitting.

AgeNING-MACHINE. W Persenting, The AgeNING-MACHINE. W Persenting, The Harbors, Minn. The invention rather to seen ing machines wherein when the thread or the shuttle is exhausted a new supply will be automatically introduced. The shuttle tread automatically introduced a shuttle tread automatically introduced. The shuttle tread automatically introduced are shuttle tread automatically introduced. The shuttle shuttle interest in the part in normal position. When the late part in normal position. When the part in normal position. When the part in normal position was observed in the release and throws into operation the means for bringing into play the new supply FRICTION CLUTCH-PULLAY—A. A. A., BARROW, Elliott, Ill. The lawention provides

means which permit of the pulleys' ready ad-justment to different speeds. It provides an equalising means for the weights mounted on the arms of the levers, to make certain that a perfect balance of the pulley is obtained. DHIVING MECHANISM FOR FORMS.—T. O. SHITE, hor S. Micanfords, Orange Hiver Colony, Boath Africa. A novel mechanical for translating revisary motion into recipros-tory motion, perficularly for use in applying

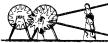


DRIVING MECHANISM FOR PUMPS.

the power of a windmill to a pump. The windwhoel carries a photon which congres a concavecance age age, reciprocating the latter, which is connected to the pump rod. The innervenement gear is held in engagement with the pinion at all times by means of a PILAGEN MACHINE—O. B. REFUNICE, POTI-LIAID, Ind. The improvement relates to a machine for making filter for packing cases used as egg boxes. These fillers are formed of stripe disposed in parallel rows and extendation for making filters for packing cases used as eggs boxes. These filters are formed of stripe disposed in parallel rows and extendation for the packing case.

SHUTTLE -T. J. CARISTO, Allentown, Pa. The invention relates to shattles, the more particular purpose being to provide the same positive chopping motion, this motion being controllated by the tension of the filling carrier from the shuttle.

certer from the shuttle.
DBIVING MEN'LIANISM—A. E. H. J.
TROBLIDEN, 109 Youter Street, New Haven,
Com. The object of the mechanism hers tillise-trated is to provide means for driving a power shaft from a crank shaft through hevers and ratchet wheels, the ratchet wheel being fixed to the power shaft and the heves operatively connected to the crank shaft to awing oppo-sitely. The letera are furnished with means toldy. The letera are furnished with means



DRIVING MECHANISM FOR SHAFT.

for engaging the teeth of the tatchet wheels to drive the power shaft. This is an improvement on a previous invention that permitted the power shaft to revolve faster than it was driven by the levers, which was objectionable whee the mechanism was applied to a voicile, as when the latter was running down grade. The prevent invention does not permit of such motion during coasting.

and accurate manner.

THERAL-VICTING SHUTTLE.-T. J.

GASSIO, Alleatown, Pa. In this patent the
invector seeks in mount disnectly upon the
shuttle a cutting mechanism which is actisated by the tension of the filling thread, and
so arranged as to sever this thread whenever
the tension of the latter exceeds a predeiormitted limit.

termined limit.

BOOTIE-WARRIER — D. SWILLY. Breaford,
In The invention provides a mechanism for
washing bottley wherein is prevented the ineral discharge of water incident to the usual
employment of a briefle breuit provides for
holding a bottle during the washing; provides
a shold for the rottery breuit for washing botlies, to prevent the discribition of the water
contained in the breuit, and economies and

simplifies the observation of washines unsimplifies the observation of washines unploying relax; cleaning bysules;

LATCH-CONTROLLAGIO DEFICE. FOR
CLUTCH MICHAINING. O. Bassara,
Frestino, III. is the do case the threation relayer to the control of the control of the control
proped upon puncting and shearing sandthney,
the more particular garpines being to growthe measure for postitivity looking and uninceting at
sanalogous member used for simpling and starting cretain mountle partie.
FRICTION-GEARING.—L. N. Lacouste,
New York, N. Y. This investion pursuins to
positively connecting driving and driven shafte,
and more particularly to that trype in which
the driven shaft may be rotated in either
of the driving shaft. Offereither of rotation
of the driving shaft. Offereither of rotation
struttle, more supechilip designed for me in
struttle, more supechilip designed for me in
struttle, more supechilip designed for me of
dillag thread in ope the shaft is not fully open
or clear, owing in extranous matter causing
a tangle of some of the warps.

BAUCHET
DEBILLS.—CHARLES B. HEATTON, STI Plessant
Avenue, New York. The holder shown in the
accompanying engawring is adapted for ratedrillis such as are used largely in read or clands
clamps by which it may be secured to a beam.



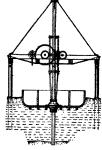
ADJUSTABLE POST FOR RATCHIET DRIVER

and mounted in this post is a rod that may be awaing to any desired angle and be secured 'Iropecting at right angles from this rod is an arm fitted with a silet, in which is a set screw adapted to hear against the head of the ratcher drill. By this means the post may be secured to one face of an angle, and the drill applied to one face of an angle, and the drill applied right angle thereto.

is provide a wheel having seeth equation of the provide and th

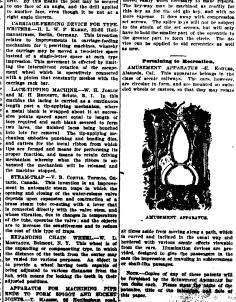
of meaning com types, and a colding of colors of a colding of colors of a colding of colors of a color of a co

Frime Movers and Their Accessories, WAYE MOTOR.—TROWNS PIXON, 815 Cha-pain Street, Manta Barbara, Cal. For the purpose of utilising the power of the waves, Mr. Nixon has devised the construction shown in the accompanying illustration, sensiting of the accessories of the construction shown in the accompanying illustration, according down in the accompanying illustration, sensiting down is allowed a shart or mast extending down



WAVE MOTOR

trie the water. Monuted to althe on this shaft is a vessel which carries ratchage adapted to operate plrinous of a gar tesin. The vessel is free to oscillate on the shaft as well as to move up and own, and all such that the shaft is the shaft of the shaft as well as to move up and own, and all such that the shaft of the shaft of





ndify write queries on separate aboets when writing a other matters, such as patents, subscriptions as, etc. This will facilitate answering your ques s. Be sure and give full name and address on over-

(12346) I. R. says: Kindly help me (15540) 1. rt. says: Kimaly help me in solving a little mechanical problem, name-ly, I daim if a ratiroad car is turning a curry, the outside wheel is making more revo-lutions than the inside wheel, that is, if the wheels are loose on the arke; but if solidly atintines than the inside wheel, that is, if the wheels are loose on the art is but if solidly attached to the axis, they make the same evonitorian, but the outside must said or gitten and the same evonitorian in the outside must said or gitten and the same and the same and the same and without skild diag. A. An editorial surfice in the Scientific Austract, or May 27th, 1905, vol 91, No. 21, price ten cents, gives a full discussive and the same rail is of ancessaly aborter than the cutor rail of a curved tree, since it is struct upon a radius of 4½ feet shorter Now if the two wheels are find to the axis, as is inser wheel must slip forter and the same and the same number of turns, in the same time, but you are unequed distance for the cutor wheel must slip forward on the length of the same time, but you are unequed distance for the cutor wheel will make a greater number of turns than the inner, if both run without slipping, since it goes over a greater length of treek.

(12347) P. D. R. saks: Have you

out slipping, since it goes over a greater length of track.

(12247) P. D. R. saks: Have you published to the Norwerier Ambricas Wire-rament details of the more prominent sero-planes? A. In Norwerance Non. 1910, 1817, "The Practice and Theory of Aviation," by Grover Cleverland Leening, A.M. This is the most compact paper on acroplanes that has probably ever been published Pourieren bi-planes and monoplanes are described in detail, the most compact paper on acroplanes that has probably ever been published Pourieren bi-planes and monoplanes are described in detail, the Parisan. (vol., Curtise, Wight, Volsie (dat mod-1), Volsien (new model), and Bommer bi-planes, and the Antionette, Ramto-Jumonf, Blefot XI, Bilviet XII, Grade, Petitree and Pfitneer monoplanes The proper dimensions flag of acroplanes are constituted as a desirable text book, 17ric, 19 cents for the set assibok, 17ric, 19 cents for the set assibok, 17ric, 19 cents for the set assibok. 17ric, 19 cents for the set assibot.

(12348) J. J. F. asks Will you please (12348) J. J. F. asks: Will you please tell as the number of pounds pressure required to compress aft to 2/3 and also 1/2 of its volume? A For 2/3 volume, we 8/2 pressure, for 1/2 volume, we 8/2 pressure, for 1/2 volume, use 2/1 pressure. As free at has the atmospheric pressure of 14.7 pounds per square inch, the pressures are 2214 pounds above vacuum or 7.35 pounds gaze, and 30.4 pounds above vacuum or 7.47 pounds gaze. Tespectively.

(1250) V. Z. salts: When I, was at school I was taught that in the comb at a certain dispit the density of the water is squal to that of sact, so that a such that in the comb at a certain dispit the density of the water is squal to that of sact, so that a such salt with the large disability than sale have to 'the from the see density than sale have to 'the from the sand with mercury. A. The teaching that water is congressible to the extent that it can, be made denser than steel was certainly of one sampless or offtens pounds per square fact will compress water sqift of one sampless or offtens pounds per square fact, will compress water sqift of unitarity of the sampless of the companies or square in the companies of the compani

Attacle I. R. cape, When Lews seven [1284] A. W. B. sake: Is a metal could be of the country of

would lift a nail with it. They said it magnetized the saife for rub it with the tongs, and they are to the said to the said to rub it with the tongs, and they are to the said to said the said to said the said to said the sai

(1253) P. P. E. asks. Will you kindly give me a precsu for gold or aliver decire-planting in a small wary. Will a devoit for ampres storage learning to the company of the control of the state of the s (12353) P. P E asks. Will you kindly

204 pounds above vacuum or 14.7 pounds gaze, respectively.

(12349) W. S. S. anks: What Serner vacuum or 14.7 pounds gaze value of the property of the propert

can't agares and the average point to to smoored 21 piezes to the right.

(12355) E. B. S. saaks: I have a little curiosity to have a matter explained to me, toosthip) it may be a supported by the same of the collection of the salver. He put the tarminded silver in water heated to the solling point in an aluminium kettle. In a few minutes the silver is absolutely bright, and no traces left salved to the salver in the salver in

Carlost

grounded at all the corners, otherwise it is a meaner to the building. See our SEPPLEMENT Now 1503, 1502, 1581, 1582, 1583, 1564, 1694, price ten cents each, for valuable articles upon the modern use and construction of lightning reds

NEW BOOKS, ETC.

HUNTING WITH THE ESKIMOS. By Harry Whitney. New York: The Century Company, 1910. 8vo; 453 pp. Price, \$3.50.

Whitney. New York: The Century Company, 1910. 800; 435 pp. Price, Company, 1910. 800; 435 pp. Price, This is a unique record of a sportamen's year among the northermost rether—its hig game hunting, the native life, and the battle for existence through the long Acric night ender the price of the company of the control of the company of

KABANG, THE ROMANO-NUBIAN CEMETERY BY C Loonard Woolley and D Ran-dall-Mactiver Philadelphia. Egyp-tian Department of the Museum of the University of Pennsylvania, 1910. 4vo., 115 plates

This heautiful monograph is the fourth vol-This beautiful monograph is the fourth volume of the researches of the Erkiey Coze, Jr., Expedition to Nubin The volume before us contains some of the most boundfully recruited plates that we have ever seen in a work on the architective of the most boundfully recruited plates that we have ever seen in a work on the architective full state of the world. The colus, the glass vessels, the glass and stone beads, the pottery, all show an extremely decurative art which in many cases transcends the principle of the proposed of

Trisonerroal Michael S. By Percy F. Smith, Ph.D., and William R. Long-ley, Ph.D. New York: Gina & Co., 1910 288 pp. Price, \$2.50 net. This work takes up the mathematical side of mechanica, and prosupposes a knowinge on the part of the student of mathematica soft emergency of the student of the student of the side of mechanical so and of the fundamentals of secretal physics. The work is based upon the expert involved the support of the student of the student of the student side of t

and Univorsity The text has hitherto been used in mineographed form on the Mossic By Francis W. Galpin. London: Method & Co. W. Galpin. London: Method & Co. W. Galpin. London: Method & Co. W. Galpin. Same is well among to antiquaries to this country, partity because of the assistance which he gave in arranging and cataloguing the dol musical finitery ments in the troubly Brown collection of the Mircopolium Misseum of vir From so discussed in the troubly Brown Collection of the Mircopolium Misseum of vir From so discussed in the trouble of the Mircopolium Misseum of vir From so discussed in the trouble of the work of authority, and this expectation Mr. Galpin has futilitied in the book before us. The subject is so went in catent that it is difficult as space of 314 pages, and in a form which would satisfy both the geometal ready and the student, an amount of material which is truly commons. Although the book is confined unrounced withough the book is confined to the student, an amount of material which is truly commons. Although the book is confined unrounced withough the book is confined to the student, an amount of material which is truly commons. Although the book is confined to the student, and amount of material which is truly commons. Although the book is confined to the student, and an amount of material which is truly commons. Although the book is confined to the student, and the student, and an amount of material which is truly common and though the student of the student o

PRINCIPLES OF WIRLLESS TELEGRAPHY By George W. Pierce, A.M., Ph.D. New York: McGray Hill Book Company, 1910. 350 pp.; 235 illustrations Price, \$3 net.

1910. 250 pp.; 235 illustrations Price, 23 net.
One would suppose that there were books applenty on the subject of wireless telegraphs, the subject of wireless telegraphs by an author who does not display a base for some perfections expisent of wireless telegraph; One might almost be led to suppose that each wireless telegraph company had its own wireless telegraph company had its own wireless telegraph company had to see whether the works telegraph company had to the detriment of wither systems. No and the suppose that we will be a suppose that the suppose the suppose that the suppose that the suppose the suppose that the suppose the suppose that the suppose the suppose that the suppose the suppose the suppose the suppose that the suppose the suppose that the suppose the suppose that the suppose the suppose the suppose the suppose the suppose the suppose that

given to classes at Harvard University. Only the non-mathematical portions of this course are here published, the object being to intro-duce the subject in an elementary way as far as possible, to discuss the proporties of electric waves and oscillations, and the general prin-ciples and methods of electric wave telegraphy for the benefit not only of the anatour and the student, but for the professional sum as well

the student, but for the professional man as well as "Anjones is Regular Finishty Triffs Br. Anjones in Regular Finishty Constitution of the River Anjones and Triffs Br. Constitution New York Hursd & Co., 1919 fellow, 266 pp. Price, 50 cents.

This is the hast of a series of sk. Hitler for boys desiling with aviation. The look resident properties of the series of production that whe hast thy may be made in the next contains about the boys different in the local contains about the boys different in the series of the

THE RELATIONS BETWEEN CHEMICAL CON-STITCTION AND SOME PRIVACEAL PROP-ERTIES. By Samuel Smiles, D.Sc London: Longmans, Green & Co., 1910

Dailing, as it does, with the chief allysical properties of the elements and their compounds, the book is a great help in discovering just what has been doos in this field. The introductory discussion of the nature of each physical property in turn is admirable. The lesson which the author teaches is that only is a more perfect solution of the problem of with which statement, no doubt, most cleaned that which statements are willing to agree. It is difficult to prepare a book upon no vota to subject with anything like a proportionate eviation of part to part, particularly when it is written from the green, the chapters dealing with each physical property have been anddithed into sections which does with anything the subject.

HISTORY OF CHEMISTRY By Sir Edward
Thorpe New York G P Putnam's
Sons, 1910

Thorpe New York G P Puttam's Sons, 1910. In this admirable little book 8fr Edward Thorpe line given in a room-richily interesting the property of the state of themselves to the mission of the state of themselves in the middle of the interestint century, in which the comments on the work of Frederick Woehler, he passes to the discovery of the cleanated clements by very simple account of radio-activity, then a discovery of action, weights and equivalents, the noticeular theory of gases, the pectodic law, valence the cleanater of arounds compounds accreated and the cleanater of physical chemistry since 1850.

cool systems of the development of physical choculatry sizes 1850

The Art of the Municipal California By Florence Jean Annell and Frank Roy, Prayric, Boaton: 1. C Page & Co. 1810 12mo. 448 pp. 17rice, \$2 min. 48 pp. 18 pp.

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DIE BEHANDLUNG UND VERWERFUNG VON KLARSCHLAMM By Dr Alexander Eisner. Leipzig. Verlag von Wil-helm Engelmann, 1910.





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(Continued from page 72.) but as the outside is much

than the inside, it is found that the oe on which the flame is burning is very rapidly diminished, so that the pressure falls off very quickly as the projectile moves forward in the bore of the gun. The projectile, of course, is always traveling with an accelerated velocity; consequently, it is necessary to have some powder in which the surface actually exposed to the flame is increase ing rather than diminishing, so as, in a measure, to keep up the pressure as much as possible in the gun. These multiple perforations lend themselves admirably to this purpose. gard this new product as being an ideal smokeless powder. I have tested some of it with the apparatus and in the manner employed by Prof Abel A powder should stand this heat test for minutes; the new powder stood tt for thirty minutes"

The pure pyro-nitrocellulose developed by the officers of the United States pavy. of which our service cannon powder is sionally taken in coal in mid-ocean f composed, could not be employed in a colliers with the same case as in port. pure state in large guns, as is now done and produce anything like as high ballis tic results, unless made in the form of multi-perforated grains. In fact, it would impossible to produce anything like satisfactory ballistic results, unless multi-perforated The reason for this is that perforated it is a dense, hard, and horny-like col-loid, and does not burn sufficiently fast to be entirely consumed in a gun, unless the web thickness between burning sur faces be comparatively thin

If made in the form of long, flat strips, they would have to be so thin that if a charge of full weight were used, the initial area would be so great make the initial pressure prohibitive; while the pressure would fall off very rapidly toward the muzzle. The same would be true if made in round rods like cordite. The rods would have to be made in mere threads, and initial pressures would be too great when ful charges were used Besides, long and thin flat strips and thin rods would break in handling and in transportation

The present powder in the form of nort, multi-perforated cylinders overshort. comes all of the above objections, enables the use of a hard colloid of pure nitrocellulose, obviates all danger of break age, enables the use of full charges, which present small initial areas and produce omparatively low initial pressures for high velocities, and enables the produc tion of higher velocities with lower in itial pressures than any other powder in the Marid

The Brucker Transatlantic Airship Expedition

(Continued from page 62)

The boat contains a fire and explosion-proof gasoline tank. The efficacy of this type of tank was demonstrated in the acci dent to "Zeppelin VI." Though the air ship was burnt, the tank remained intact. The boat has a length of 10 meters, a sem of 31 meters and a depth of 1.75 meters It has a navigating and living cabin, equipped with a very complete set f aeronautical and meteorological instru ments, a workshop and a large store of provisions. Its equipment includes water anchors and drag ropes. The civelope has the usual maneuvering and safety valves, both in balloon and ballonet, made owtra large for sufety. It has stabilizing seval ships Directly below the envelope a light passageway is suspended, reached from the boat by a rope ladder. It gives direct access to the envelope and the valves, and serves also as additional

cur in the tropical ocean. At this see regards son the Canary Islands would be see far and he north, for the trade wind passes farther ottes). south at that time of the ye touches Teneriffe.

Secondly, it is intended to shorten distance to be covered as much as possible and so the island of Saint Vincent, in the Cape Verde archipelago, has bee lected as the actual starting point. These islands are in the very be

the trade wind; they have a very steady climate, and are exempt from thunder storms

It is hoped that the "Suchard," with its own speed of 18 miles, plus the steady trade wind having a minimum of 16 miles will make at least 34 miles an hour and cover the distance, if the machinery holds out, in about five days. If there are breakdowns it will take longer, but the trade wind will insure continuous progress in any case, and there are no risks that could be in the least compared to those that Wellman faced. On this peaceful stretch of water steamers have It should be easy to launch the motor boat in the water, if the gas bag for any rea son should have to b set adrift. Having the gasoline tank right aboard, and with two 200 horse-power motors, it should prove as safe as a steamer. The whole equipment, moreover, is located in the boat from the outset, and does not have to be transferred, as in Wellman's craft

It goes without saying that all the re sources of maritime navigation will be used to keep the course exactly. The ship is now being assembled in the large, nev air docks at Kiel, where it will be christened with impressive ceremony.

The Diet of Athletes

(Continued from page 64.)
"The idea of applying Siegfried's diet

and mode of life to other pupils immedi stely suggested itself, but it proved to be utterly impracticable. In most cases it impossible to control the stomach which simply 'struck,' and refused to per form its duty. A friend of mine so in jured his stomach by four successive sup pers a la Siegfried, that he suffered sev weeks with dyspepsis.

"In similar circumstances I observed two other celebrated strong men, who ate more meat than Siegfried did, but were otherwise moderate eaters. The food provided for them in my house was always 'tasty,' however, and my experience leads me to place more value on the flavor than on the chemical composition of food.

A fourth and very interesting example is furnished by the professional athlete Petrus Bareuther, whose measurements taken September 22nd, 1910, before exer rise, are given below: Height 5 feet 7% es, weight (nude) 167 pounds, che inches, weight (nude) 197 potents, cases defiated 37.4 inches, chest inflated 45.7 inches (an extraordinary expansion), waist 31.8, thigh 22.8, calf 15.1, right upper arm extended 146, right upper arm contracted 17.0, lower arm 13.5, chest over rms 52.4.

"Bareuther was a foundling and his childhood was passed in extrem His food often consisted solely of dry While working in a factory for four dollars per week, he joined an ath-letic club. After serving his time in the army be came a professional athle wrestler. Now, at the age of 27, he appears to be the strongest man of his weight that has ever appeared in the athletic field, for he is the only man who has lette field, for he is the only man wao assilifted a weight as heavy as his own body from the ground to arm's length above his head, with the left hand as well as with the right. The world's record in from the boat by a rope ladder. It gives with the right. The world's record in section the energy pent up in the water direct access to the envisions and the performances of this class is held by the provider already and the provider access to the envision of the class is held by the provider already and the provider access to the envision of the class is the provider access to the provi

erd, with a little attent hatitle the probled t ottes). Bureut a (110 p voighing 50 kilowe with an en The secret of strength deserves careful stud

ens of men who ate much more, some of whom ate almost incredible titles of meat, without acquiring any like the strength and er four remarkable men.

"The general result of my observations is this: Every person is a law unto himself and requires certain foods, from which his digestive organs can best extract material and energy. The required tract materia and energy. The required diet varies greatly, both in quality and in quantity. The preparation of the food, the manner of ohewing, the dignetive powers, and certain imponderable factors exert a great but yet unknown influence. In general, that person is nearest physic perfection who can develop the greate energy from a moderate quantity of the simplest food. Good air must be regarded as one of the most important articles of food, for strong men, without exception, have good respiratory power."-Th ert in Die Umseh

Utilization of Solar Radiation and Wind Power

(Continued from page 65.) which the sun is sending con-to us. In the meanwhile a vast

stantly to us.

amount of available power received daily from the sun is allowed to go to waste, and our supply of coal is diminishing. The prospect of a time, not very far distant, perhaps, when our coal supply may be exhausted, has naturally turned men's attention to other seemingly then haustible sources of power. The first such source to be setsed upon has been the power of waterfalls, and the develop-ments in this directions are well known to our readers. But a waterfall is mere-ly a means of indirectly tapping the en-ergy of the sun's rays; for the sun shining upon the vast surface of the sea and other low-lying sheets of water. large quantities of this in the form of vapor against gravity into clouds above These, wind-driven over land, and strik ing mountain ranges, are presently pre-cipitated at a higher level in the form of rain. The water gathers into rivers, and the work done upon it by the sun in rais-ing it from sea-level to the higher altitudes appearsein the form of potential energy of elevation. In the natural of events this energy is gradually degenerated, converted first into kinetic energy of the moving stream, and finally into heat. But so long as this process is not carried to its final conclusion, so long as the water is still above sea-level, its en-ergy of position or of motion is available to us for utilization in water-wheels or es, or any other suitable device. And of course the best conditions for tanping this source of power are pre in waterfalls.

Now the location of a waterfall is a matter lying outside of our control; nature has not consulted our convenience in the selection of sites for these things. But why should we remain depend and why should we remain dependent upon nature? Why not make a waterfall where we want it? Remember nature's arrangement: a lower reservoir, the sea; the sun's rays lifting the water from the surface of this sheet, the wind carrying it to a suitable condensing ground; the piver and waterfall, setting free for utili-sation the energy pant up in the waters

at: why not utilise the sun's rays di one cannot quite shake off the feeling oily for power purposes? ourposes? There is an The sun shines but a obvious objection. The sun shines but a fraction of each day, the stream of energy which it sends to us is intermittent and variable. So it would seem that the most rational procedure would be to store energy by day, and draw, as occasion requires, from our store. And it appears that water reservoirs are about the cheapest form of energy store available for the purpose. A most interesting account of a project of this character, in count of a project of this character, in | There are some walks in life, some mis-part realized, it appears, at the present isons, which are eminently woman's day, has been given by R. A. Fessenden sphere. The pursuit of scientific research before the British Association, and is is perhaps not one of these This, how-reproduced in our Sciptzkinky of this ever, does seem probable, that the pres-

A STATE OF THE PARTY OF THE PAR

plant for utilising the sun's radiation, ever may be the causes of the disparity and for exploiting wind-power, each feeding the same water reservoir. The less is the second complaint made general arrangement is shown in ideal women, it is claimed, are hardly considrepresentation in the accompanying il-lustration. In the actual installation, the detail features of which are not disclosed,* an existing mine shaft has been utilised. At night the radiation plant would necessarily be at rest, but on the other hand the wind is usually higher than during the day. There is thus a tendency for conditions to even themselves out, and the working of the joint plant would approach uniformity Fessenden's paper represents a most inter esting step in a direction for which there to be promise of important ulti mate developments, and should be read by every one interested in the major events in the progress of arts and science.

Women and Scientific Research

In a recent paper published in Science ssor Cattell, under the title "Statistical Study of American Men of Science." reference is made to the fact that women are contributing but a very small share to productive scientific work. In times the volume of sea water which 1919 only eighteen women are found would suffice to supply it with all the among the first thousand scientific per- (arbon it requires in the form of dis-The author says, in part "There are now nearly as many women as men o receive a college degree; they have on the average more leisure; there are four times as many women as men engaged in teaching. There does not appear to be teaching. There does not appear to be any social prejudice against women engaging in scientific work, and it is difficult to avoid the conclusion that there is n innate sexual disqualification. . . . But it is possible that the lack of encourage ment and sympathy is greater than ap-pears on the surface, and that in the future women may be able to do their share for the advancement of science."

Not unnaturally this passage rought out some discussion raised. Two letters appear in the correspondence column of Science over the signatures of ladies, who rise in protest and in defense of their sex. They urge that the general conditions of education and of college administration are such as to place unnatural obstacles in the path of women bent upon scientific attainment.

One correspondent completes that the le spirit of a girl's education, from childhood up, lays far too much stress upon attention to her apparel and adorn-ment, that the boy is free from such tramand has correspondingly more leis ure to give thought to things of greater worth. A boy is taken by his elders to visit various places of practical interes., thus preparing his mind for the solid duties and life work of the man. No one thinks it necessary to pay the same serv-ice to girls. Yet, the writer claims, the practical instinct is innate in girls as in "It was a little girl who once Why do the cars lean in when

so around a curve?"
.must be admitted that there is justifiation for these statements. Men do like the big has never been very popular. But ed whether this plant simplier a high or in monty what delies

that the fault, if fault there be, does not rest entirely with the male sex. If women are in this matter the victims of circumstances, one rather suspects that most of them are willing enough victims. And, perhaps, this spirit of willingness, rather than the force of circumstances is one of the true causes why w not figure as prominently among scien tists as men. One might ask the question whether it is desirable that they should There are some walks in life, some mis ent proportion of eighteen in one thousand anden proposes to install jointly a does not represent a fair condition, whatered seriously as candidates for major positions at universities And it is the holders of such positions who are contributing the main share to the advance-

Sea Water a Liquid Food

It has hitherto been supposed that marine animals derive their food from each others' bodies and, in the last analfrom plants, says Prometheus A few years ago, however, Puettner dis-covered that the sea contains dissolved food materials, upon which some marine animals, notably sponges, appear to live exclusively A given volume of sea water contains in dissolved condition 24,000 times more carbon than it con-tains in the form of organisms. Puettner proved that one species of sponge, if it were compelled to exist upon ready formed food, could obtain in one hour only 1/2300 of the quantity of carbon which it consumes in that time; and order to obtain even this small quantity, it would have to fish over twenty solved complex carbon compounds Very served fact that comparatively small quantities of ready formed food are found in the digestive cavities of the lower marine animals Hence sea water is, for a great many invertebrate animals, a nutrient fluid from which they absorb food, as the cells of animal tissues absorb food from the bodily fluids, and mal parasites from the media in which they live, and all plants from their en-The sea is an inexhaustible reservoir of food

The Speaking Clock

There is nothing outwardly remarkable, according to Das Echo, in the an pearance of the ingeniously constructed timepiece known as the "time-stating timepiece known as the "time-stating clock." But every quarter of an exceedile voice issues from it, an nouncing the correct time, as, twelve o'clock, twelve fifteen, twelve thirty, etc. The works of the clock actuate a stout belt, which runs over a roll con

nected with a sounding box.

Upon this belt, or rather film, the hours, which have been recorded by a phonograph, are impressed by galvaniza-tion on a copper plate.

The mechanism which moves the hands is connected with the speaking device, and this with a funnel which re ward through a finely grated opening at tached to the narrow side of the clock
At night a touch on a lever reduces
the clock to silence. But if one wakes
and wishes to know the hour without striking a light, an easily found buttor is pressed and the clock immediately states the time.

The speech film is practically inde-structible and occupies very little space since, because of its elasticity, it may be wound upon a very small roller.



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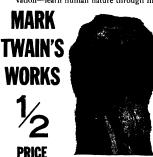


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Electricity

Telephone Train Dispetching.—The ennsylvania Railroad has installed a complete telephone train-dispatching sys-tem at its terminal in Philadelphia, which is said to be the first of its kind in a terminal station

An Electrical Week at Turin.—The In-ternational Electrotechnical Commission remaind determined (commission) to the tome at Turin, Italy, during the week beginning September 11th, 1911 The Lates Effith Dreadnought.—
week beginning September 11th, 1911 The four new dreadnoughts to be built at the same time there is to be at Turin it his year for the British navy will be an International Exhibition of Industry 565 feet long, and of 24,000 tons displace. and Labor Recently it has been planned to have as well an International Electrical Congress of the Applications of Electricity. This proposed meeting is being organized by a committee appointed by the Associazione Elettrotecnica Ital-

A Simple Current Test. -A letter published in a recent number of Power suggests a simple method of determining whether the current in a lamp socket is alternating or direct On holding one pole of a permanent magnet against one side of the globe of a lighted lamp, it is found that if a direct current is flowing through the filament, the latter will be either attracted toward or deflected from the magnet, while if alternating current flows througa the lamp, the filament will vibrate, due to the riternation

Chicago Automatic Telephone Service. installation of automatic telephone service in Chicago is progressing satisfactorily Four exchanges are besatisfactorily Four excusures and ing built in the business section, and four others in outlying districts. The central exchanges are to have a capacity of 34,500 lines to start with, but the capacity will eventually be doubled The system when completed will have a capacity of a million lines The Illinois Tunnel Company has already 37,-000 contracts for its new system nects to start service before the first of April with 20,000 telephones

The Chicago Electrical Show. nual show of the Electrical Trades in Chicago opened on January 7th in th Coliseum It is one of the most success ful exhibitions of its kind, there being about a hundred exhibitors The annex of the building is taken up almost entire ly by the United States government, in which all electrical apparatus pertaining to various departments, is on exhibition One of the most interesting of these is the representation of the electrical equip ment of a battleship. The navy has reently decided upon the use of electricity for cooking purposes aboard warships, and this is illustrated in the government display The ma.n hall of the Coliseum is beautifully illuminated, the roof being ed to give the appearance of a huge tent with a rectangular opening in the center, through which the blue sky and fleecy clouds may be seen. This effect is produced by means of indirect light-ing. The booths are in the form of rgolas, covered with vines

Cell Sensitive to Light .- A unique elec trolytic cell which is sensitive to light was recently described by M. H. Pelabon before the French Academy of Science The negative electrode of this cell is nure intimony, and the positive electrode alloy of antimony and selenium The solution in which the electrodes are im-mersed consists of trichloride of antimony and hydrochloric acid. If this cell is kept under uniform conditions of temperature and in perfect darkness, its voltage remains constant. However, should the positive electrode be illuminated, the voltage would rise at once nearly fifty per cent. But the cell would not maintain this voltage, even though the light were kept steadily shining on the electrode, but would gradually diminsh, until, after a period of about 20 minutes, it would reach its initial voltage Thereafter, should the light be cut off, the voltage would drop at once about fifty per cent below the initial voltage, and then would rise slowly to the normal voltage.

Engineering

Hudson Siphon 1136 Fest Deep. -For been carried on in the search for solid rock below the Hudson River, through which to carry the siphon leading to the Catakill aqueduct on each side of that river Solid rock has found at a depth of 1,130 feet, Bolid rock has now

555 feet long, and of 24,000 tons displace-ment. They will mount 10 13½-inch guns, all in turrets on the center line, and 16 4-inch guns for torpedo defense The speed will be 21 knots on an 8-hour

A Fire College.—The establishment in New York of a fire college, the first of its kind in the world, brings to mind the fact that this city was the first to organize trained volunteer companies and the first fire department equipped with a paid force To the original work done by this institution is to be credited most of the modern fire-fighting and life-saying devices

Fuel Oil on Railroads.—That the advantages of fuel oil in place of coal in the operation of railroad trains are coming into increasing recognition, is she by the growing consumption on those railroads that are advantageously placed for the purchase of oil. The consump tion on the railroads of the United State in 1909 amounted to 19,989,394 barrels an increase of 18 per cent over the previ ous year

Travel of Shots Under Water. — anval board is carrying on experiments in determine the course taken by a projectile after it strikes the water, with a view to determining what damage a sho may do to the submerged portion of a vessel after it has passed below the sur-face. The flight of the projectile is beface ing determined by placing a series of fish nets below the water, and noting the course by the perforations.

Parlor Cars at Panama. -The instituthe first of this year of a parlor car service on the Panama Railroad is suggestive of the interest which is being taken in the construction of the great canal There will be an observation platform, capable of seating twenty people, on each end of the car If, as expected, the car proves to be profitable, all passenger trains will be equipped with one of this type

The Loftiest Rallway.—The highest railway in the world, according to "Peru To-day" is to be found on the Morocoche branch of the Central Railway of Peru The summit of this line, which is broad gage, is exactly 15,365 feet above sea level To reach this point from the sea, the line passes through 57 tunnels, over a dozen important bridges and through 13 switchbacks Although the grades ar heavy, no rack propulsion is utilized.

Protection Against Submarines.—The French are experimenting with a new device for protecting warships against submarines when the former are sta-tionary. It consists of groups of cyligders, about two inches in diameter, filled with high explosives and moored around the battleship, the cylinders being so con nected with each other that when a submarine comes in contact with one or more of them, it is entangled by the entire group, whose simultaneous detons tion wrecks the submarine.

Coal Dust Explosion Experim Experiments already carried out by the Mining Association of Great Britain to determine the phenomena of coal dust explosions have shown that, under favorable conditions, such explosions can be made to occur. When a jet of dust was ignited in an artificial gallery, a large cloud of dust was ejected, and a fame shot out of the mouth of the gallery, ding through the dust to a distant of 180 feet. The report of the explosion was audible for a gistance of seven miles.

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YPEWRITERS. Writers

Aeronautica

First Aviation Victim of the New Year. While making an Beigrade, the capital of Servia, a Crotian aviator named Roussijan is reported to have fallen to his death on January 9th His machine became uncontrollable He attempted to alight in a river, but instead collided with a build-The death of a lad named Archer, who was reported to have been killed at Salida, Col, recently in a machine pro-pelled by an electric motor, has been found to be a canard. Thus the year 1910 has one less aviation victim to account for

Protective Legislation for Aviators. The interest in aviation aroused by the recent meets at Los Angeles and San Francisco has resulted in the framing of bills to license aeroplanes and protect their pilots by the California Aero Clubs These bills will be submitted to the Legislature of that State in the near future. Among other things, they provide that an aero-planist who is obliged to descend upon private property shall not be liable except for the actual damage he causes, and an amendment to the penal code is asked for. making it a felony to shoot at an acro plane in flight

The Bennett Cup Race for 1911. -The rules for the international aeroplane cup race for the Bennett trophy for the present year were promulgated at the hame-White's victory for that country at Belmont Park last November. Officers of the Acro Club of America attempted to have the rules changed so that only machines built in the countries which they represent could be used in the race, but in this they were unsuccessful.

Delivering Newspapers by Aeroplane The first attempt on record at delivering newspapers by aeroplane was made by D Masson on January 7th during the Los Angeles meet Masson left Los Angeles in the forenoon with several bundles of newspapers to be delivered at Pomona and San Bernardino He missed the former place and became lost among the gave out and he descended rather heavily. 12 miles west of San Bernardino. Despite the breaking of an oil tube, he finally reached this place, 5 hours and 40 minutes after leaving Los Angeles While giving an exhibition in the park there during the afternoon, his Curties type biplane again landed heavily and was hadly

Winner of the Statue of Liberty Prize Still Undetermined .-- The International Aeronautic Federation, at its special meet-Aeronauti-Federation, at its special meet-ing on January 11th in Paris, did not give New York is 37 inches, Boston of a decision upon the winning of the Ryan and Philadelphia 22 inches, that these algorithms of the Paris of the Ryan and Philadelphia 22 inches, that these white protect against same. The whole Manchester, and that wages are higher matter was referred back to the Aero, here than in England. Club of America for a new classification and new results. While White was the only competitor who had complied with the original requirement of a flight of an hour at the Belmont Park meet before attempting the prize flight, it was shown that he had fouled the fifth pylon in starting, which should have caused his disqualification. According to Rule 29 of the Federation, the rules of aeronautic meets cannot be changed after publication. except with the consent of the contest committee of the governing club. As it was not shown that the abolishing of the hour flight requirement was done with the consent of the contest committee of the Aero Club of America, a majority of the delegates present passed a resolution declaring that the change in the rules did not conform with the rules of th International Aeronautic Federation, and that, therefore, the matter was referred back to the Aero Club of America for straightening out.

Science

A New Rain Gage. -- A new form of rain-gage, introduced by Messis Casella & Co., of London, is insulated from the effects of temperature in either evaporating or freezing the collected rain-water. The method of insulation is exwater. The method of insulation is ex-tremely simple, consisting of an air space between the inner and outer walls of the receiving-vossel

Atmospheric Exploration in Uruguay. is understood that aerological obse vations (i c, soundings of the upper air) will soon be undertaken at the National Physico-Climatological Institute of Montevideo. A letter from the newly appointed director of the Chilean meteorological service. Dr Knoche, states that similar investigations are contemplated at Santiago

International Magnetic Study,—The work of the organization hetetofore known as the "International Commission on Terestrial Magnetism and spheric Electricity" will henceforth be limited to the former of these two sublects, and its title has accordingly been changed to "International Commission on Terrestrial Magnetism" A separate Terrestrial Magnetism" A separate commission on atmospheric electricity be apointed by the International Meteorological Committee

Meteorological Units. - Reforms in the existing units used in meteorology have been repeatedly urged in recent especially the adoption of the absolute meeting of the International Aeronautic temperature scale and the substitution of Federation on January 10th They pro-C.G.S. units of force for the height of vide for a 150 kilometer (93 15-mile) race the mercurial column in the measureabove a suitable aerodrome The race ment of barometric pressure However, will be held in England owing to Gratee, at its recent meeting in Berlin, de cided that it could not yet give its ap

proval to any of these suggestions
Shaw's Lectures on Meteorology.—
Lectures on "Modern Meteorology, Dynamical and Statistical," to which admission was free to the public, were given by Dr. W N Shaw, FRS, at the new quarters of the Meteorological Office, in Exhibition Road, London, on November 21st and 28th Two collections of lec-21st and 28th tures by Di. Saw are to be published shortly under the titles "Forceasts of Weather" and 'Climates of the British Possessions," the latter being really a work on general climatology, with illustrations drawn from the British possions.

What Snowstorms Cost -- The cost of snowstorms to a large town is illustrated by the accounts of the Corporation of Manchester (England), where it is stat-ed that to clear away falls aggregating 15 inches in depth during the winter of 1909-10 entailed an expense of \$29,705 and gave employment to no fewer than 15,640 men. To give an idea of the probably much greater expense of such work in our large American cities it may be stat ed that the average annual snowtail of

Meteorology in Argentina.—From a recently published description of the Ar gentina meteorological service, by R C. Mossman, we learn that this service now possesses 32 first-class stations, equipped ments: 148 second-class stations, where observations are made at 8 A M, 2 P M, and 8 P. M, 10 third-class stations, and 862 fourth-class stations The weather map includes, also, reports from several stations in Brazil, Chile and Uruguay, and thus shows the meteorological conditions relating from Para (Brazil), situated on the equator, to th southernmost limits of Argentina, ex southernmost in the second of 55 deg latitude, reports being received by wireless telegraphy from New Year's Island and Ushuala. The service also maintains 111 river-gages, and issues flood-warnings besides carrying on extensive observa-tions in terrestrial magnetism and seis



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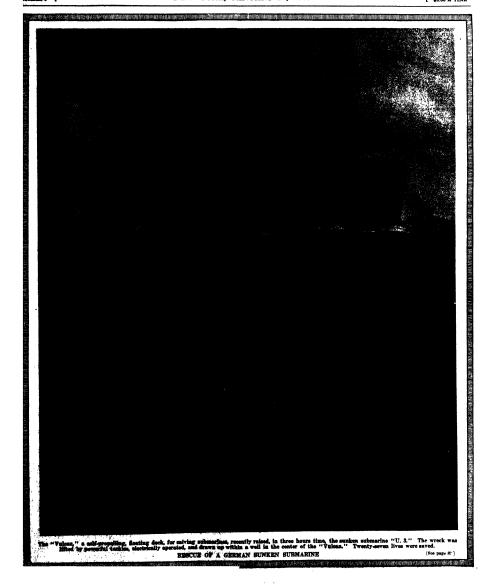


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SCIENTIFIC AMERICAN

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The purpose of this journal is to record, accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasise the inherent charm and fascination of terms.

The Reefing Aeroplane

HK speed of the scroplane has reached a point at which the need is felt for some system of "reefing," by which the area of the supporting surfaces can be varied to suit various speeds at which the machine may be sing. This demand for a variable surface is due to one of the most important of the laws of flight; to one of the most important of the laws or ingur; namely, that the area of the necessary supporting surface of an acroplane varies inversely as the square of the velocity. This principle, affirmed by Langley and embodied in his great work "Experi-ients in Acrodynamics," has been disputed by some ments in Aerodynamics." has been disputed by some European theorats and practical aeroplane builders, but the experience of the last two years scens to verify it. If the law hold good, the standard Wright aeroplane, which, with about 300 square feet of surface, has a speed of 40 miles per hour, at 60 miles with a speed of 40 miles per hour, at 60 miles with a speed of 40 miles per hour, and at 100 miles per hour, only 90 square feet.

Now, that the law is generally correct, or at least the speed of the spee

Now, that the law is generally correct, or at least that it does not produce too great a reduction of surface, as shown by the two very interesting racing machines exhibited and flown by the Wright brothers at Belmont Park last autumn. One of these, a semi-racer with a speed of 60 miles an hour, was provided with only 150 square feet of sustaining surface. The standard Wright machine, driven at 60 miles an hour, would need, according to the law, 225 square feet of surface. Its weight, however, with operator and full fuel and water supply. ss 1.075 pounds; whereas the 60-mile semiply, is 1,075 pounds; whereas the 60-mile semi-racer weighs with operator and fuel only 760 pounds. The difference in weight would largely account for the reduction of the area of the 60-mile racer, from 222 down to 150 square feet. Further racer, from 222 down to 150 square feet. Further verification of the law is found in the Bleirott racer, which, with slightly less speed, and a weight of about 630 pounds with operator, also has but 150 square test of sustaining surface. It is significant that in the actual racing machine, which is 15 miles an hour faster, the Wrights did not venture to reduce the sunwortne surface any further, both

miles an hour faster, the Wrights did not venture to reduce the supporting surface any further, both the semi-tacer and the racer having 150 square feet of of surface. The racer, however, is heavier, weigh-ing, with operator and fuel, about 900 pounds. If, then, the high speed figers of 1910 have en-dorsed the Langley law, it follows that there will be a still further reduction of area in the racing machines of the future. If the standard Wright machine with 500 square feet of surface, could be driven at 100 miles an hour, it would need only 80 square feet of surface for support, and if a speed square feet of surface for support, and if a speed greater than 100 miles per hour were accomplished, the sustaining surface would come down to a pair of long, narrow blades, approximating in form to the wings of the swift or the swallow.

wings of the swift or the swallow. But it must be remembered that these reduced surfaces are equal to their work only if the machine is being driven at its highest, or at least at high, velocityst and they are therefore theoretically too small to lift the machine from the ground or allow it to return safely thereto at the lower speeds which is recessary in starting and alighting. Proof of this was shown in the accident which disabled the

Wright racing machine at the time of the centest at Belmont Park for the international trophy, when the stopping of the motor and the sudden alowing down of the biplane caused the machine to drop so swiftly to the ground that its momentum partially wrecked the machine and threw the aviator from wrecked the machine and there the aristor from his sect. Probably, having been accustomed to the larger-surface Wright machine, he did not realise that he should descend with his main planes at large angle of incidence in order to check the valocity. In any case, it is evident that, if the racing acrophane reaches a speed of 100 miles an hour, it will be necessary for safe control, toy re-vide it with some means for enlarging or reducing the supporting area proportionately to the speed. The problem should not be so very difficult of solution. The additional surface could be arranged to be drawn under or within the main surfaces

solution. The additional surface could be arranged to be drawn under or within the main surfaces of the from the ends or from the rear. If, as we believe, the machines of the future will be built entirely of metal, the problem will be so much the casier to work out; but it should not be impossible to arrange some system of "reducing canwas" in the present type of machine, by drawing the furled surfaces into such a form that they will not offer any material head resistance.

any material head resistance.

A large percentage of the accidents to the existing machines are due to descending and landing at too great an angle or at too great a speed. Were it possible voluntarily to increase the surface at the time of making a landing, the risk of accident from this cause would be largely reduced.

Emancipation of the Truck Horse

N entering the Madison Square Garden auto-mobile show and looking over the superb exhibit of motor trucks and other commercial vehicles, we were impressed with the conviction that if the "horseless age," of which we have heard and talked so much recently, is not and the mean and talked so much recently, is not already upon us, it must be very near at hand. The impression of power, capacity, and speed was instantaneous; and we felt, as many another visitor to the show must have done, that what steam and steel had done on the railroad, gasoline and the rubber tire were destined to accomplish upon our streets and thoroughfares. There came to mind the story of the southern negro who, on seeing the first electric car to be shipped to the South, exclaimed: "These northerners are a mighty wonderful people. First they free the negro, and now they've freed the mule." If the commercial trucks exhibited at the mule. If the commercial trucks exhibited at the Garden can show in daily service the endurance and capacity which are claimed for them on grounds of theory (and many carefully-conducted tests would indicate that they can), we may look for a steadily increasing aubstitution, for the horse-draw vehicle, of the motor-driven truck and delivery van.

In the development of new industries there generally occurs some critical period in which, because of the final mastery of some difficult and essential clements, the art experiences a sudden and very decided development, and thereafter progresses by leaps and bounds to take its place among the lead-ing industries of the time. Such a period occurred in the development of the passenger-earrying automobile, and there are well-defined indications that
the present year marks a similar stage of progress
in the development of the commercial vehicle. Strong
proof of this is found in the fact that whereas in proof of this is found in the fact that whereas in previous years, exhibitors of commercial vehicles were usually accommodated in a gallery or in the basement of Madison Square Garden, this year the number of exhibitors was so great that it became necessary to split the exhibit into two periods, extend the time to two weeks, and to give up the whole of the second week to commercial vchicles.

Perhaps the most marked impression left by this exhibit is a sense of the high character of the mechanical work, both as regards the care and intelligence shown in the design and the excellence of the nuterials and workmankly, in which respects these locomotives of the highway compare favorably with

naterials and workmanship, in which respects these to compute some and the solution with the engines of the steam realroad. In comparison with the radiocal decomotive, the motor track enjoys the great advantage that it does not have to develop the tools, the material, the shops and the workmen that are necessary to its own fabrication. All of these it finds not only ready to hand, but eager to place themselves at the service of the new and place themselves at the service of the new and promising industry; and it is because of these con-ditions that the motor truck, just as soon as it had proved itself in actual service, developed into the perfected finshine which can be seen in so many forms and sizes at the Madison Square Garden

show. The high class workmanship to which we have referred characterises practically the whole of the exhibit, which covers a surprisingly wide variety of vehicles, from the diminutive single-orlander, tri-

cycle delivery truck, operated by one rate, as the heavy nerchandles in bulk. A truck of the large tendent milk and coal trools for familiars heavy nerchandles in bulk. A truck of the laterance capacity was exhibited, and at the preceding tendent of the second of the largest and around New York city, the combined capacity of and around New York city, the combined capacity of which for a day's service is one thousand tone of coil. These ten trucks alone mean the climination of all class tirty of the largest and heaviest truck house from the city streets—a consideration which shows from the city streets—a consideration which shows to reduce congestion and improve sanitary conditions.

bow rapidly the growth of the inassety was serve to reduce congestion and improve sanitary conditions.

The great variety of uses to which the commercial vehicle is being put is strikingly shown at the Garden; for, side from the impressive exhibit of five and ten-ton trucks for carrying coal, butchers supplies, and other heavy freight, there was ambeliance wagons, five engines, hose carts, police patrix wagons and delivery wagons designed for a wideragently equipped with double-upposed horizontations, the larger with four-cylinder motors ranging in power from 30 to 45 horse-power. Among the chibits that attracted special attention was a 3-tos motor truck, with a removable leading box, which can be quickly rolled on and off the truck—an arangement which greatly reduces the time of leading and enables the truck to be kept in continual operangement which greatly reduces the time of leading and capable to the truck of the frame being hinged and capable of being away goep no allow the engine to be bedily withdrawn. The object of this arrangement is to make it possible, on amouncing the breakdown of a truck from the nearest pelphone booth, to have a duplicate engine shipped to the truck, mounted and connected up—the last capable of the proper description of the struck place themselves under arther heavy guarantee, that the owner shall not lose a day should the motor break down.

The important section of the exhibit reserved for electric whicks gave striking prof that the storactive whick gave striking prof that the storactive whick gave striking prof that the storactive whick gave relative places were chiefly of the light transbout type, and some dainty and beautiful many contents of the light transbout type, and some dainty and beautiful many capable of the places were chiefly of the light transbout type, and some dainty and beautiful many capable of the places are chiefly of the light transbout type, and some dainty and beautiful many capable of the chiefly recognition, and the capable of the capable of the chiefly

e electric pleasure vehicles were chiefly of the The electric pleasure vehicles were chiefly of the high runabout type, and some dainty and beautifully-finished exhibits were shown in this line. Particularly attractive was a four-seated, closed, electric carriage, offered for the very moderate price of \$1,750, and credited with a mileage per charge of 75 to 90 miles; also a new four-passenger brougham or wo mice; and a new nour-passenger brougham equipped with a direct purgear drive. An exhibit in this section which was viewed with great interest was the new Edison battery, which was shown upon several types of pleasure and commercial vehicles.

several types of pleasure and commercial vehicles. An Adams express wagon which had been in daily use for several years and had made a trip from Washington to New York was one of the noteworthy electric vehicles using Edison's cells.

Historical exhibits of pleasure cars and of bicycles were two of the features of the second show. The development of the latter from the "hobby-horse" of 1846 to the speedy motorycle of to-day, of which a score of different makes was exhibited, was interesting in the extreme.

a sorre of different makes was exhibited, was inter-citing in the extreme.

By no means the least encouraging feature of this year's exhibition was the fact that although the siales and booths were well filled with visitors, a large majority of these were either interested in the de-sign or manufacture of commercial vehicles, or were esent or prospective users of the same.

Why This Neglect?

Why I has Negaect?

Will it it hat the Dissel motor, which must be considered as one of she triumphs of German mechanical genius, has been so greatly neglected in this country that there is to-day no American firm engaged in its manufacture? Here is a new type of motor, sound in principle, economical and durable in operation, guaranteed both in laboratory tests and under various conditions of commercial operation, which for some reason or other, has been totally neglected in the Histori Strates. In word of this devability. for some reason or other, has been totally neglected in the United States. In proof of this durability, we quote our contemporary, The Engineer, which is a recent issue refers to the test of a 800-horse-power, two-cylinder Diesel motor, that rais cosmismosaly for seven and a fit smeths, from April to Streenther of last years, Daring this patient of Streenther of last year, Daring this patient of the streenth of neither the valves on the air souspreasor nor no-pitans or cylinder covers wayer vanoved, and even the hearings were not implected. We use at the dawn of a motor-driven occur, staugathy are, and it is the Direct motor valid, is being installed in the first vessels with studies; for closes every the United States in here as part in this description.

Sir Francis Galton, F.R.S.

The Passing of a Peer in Science

SOLEMN tidings come to us across the sea. On January 18th, at the ripe age of eighty-nine, for Francis Gelion, prince and patriarch among contemporary men of selence, has passed out of his searchly sphere of action. Mingled with our sense of joss, are feelings of gratitude for our rich heritage, the life-work of a man of genius, freely given, in generous and unstituted abundance, a monument to him, to us a seed from which shall spring a harvest of a value we know not yet to gage.

It is well at such moments as this to pause and take time for brief meditation upon the life of the one who has completed his labors; to pick out from among the infinite variety of the world's progress and activities that strand which is woven into analytic the contribution of the contribution of the contribution of the progress of the progress of the contribution of the progress of the progress

Sir Francis Gaiton was himself a striking illustration of a phenomenon to the study of which some of his main efforts were directed—an

tion or a passionnemia to the study of which sooms of his main efforts were directed—an instance of "bereditary genius". His grand-father, Samuel John Galton, is described as a "scientific man of business of a statistical turn of mind." He accumulated a considerable fortune, which testifies to his commercial talent, and which became indirectly the means, in the liberal hands of his descendant, of financing several of, the scientific enterprises of which the latter was the gasterous pattor.

Banuel John Galton was a fellow of the Lunar Selesty, a private oble formed for the clauser Selesty, a private oble formed for the discussion of scientific and philosophical top ics, and including such illustrious men as Priestley, Watt and Erasmus Darwin. The last mentioned was Galton's maternal grandfather by a second marriage. By first wedlock be was also grandfather to the great Charles Darwin. There is a close relation between Galton's extensive studies in heredity and Darwin's monumental works on evolution, a relation which we should hardly be disposed to sacrible to pure accident, and which itself probably represents an instance of similar characters inherited from common ancestors. More of the nature of coincidence, though none the less interesting, is the fact that the Austrian Abbot Mendel, whose name is now so constantly referred to in connection with the law of inheritance of unit characters, was born in 1822, the same year which gave Francis Galton to the world.

After receiving his early schooling at King Edward's School. Hirmingham, the sixteen-year-old boy was placed by his father into pupilage at the General Respital of the same city to prepare him for the madical profession. In his "Memories of My Life" Galton presents to us a quaint picture of these days, illuminated in a genial and oft-times humorous light. He tells an ancedots how in his early enthusiasm he resolved to make himself theroughly familiar with the properties of all the drugs in the Paramacorpica by taking a small dose of

Pharmacoporia by taking a small does of sach, beginning at the letter A, and going right chrough the alphabet. His enterprise, however, was brought to an abrane, conclusion before he had completed the letter C—By a dose of two drops of crotton oil, the affect of which discouraged further experions to this kind. On another occasion he relates how a severely injured man wise brought to the action ward in a state of does intoxication, and how the drunkard later awoke from his stupor to find that his legs had been amputated while ho was unconscious. The significance of this occurrence, which did not fail to strike the young medical student, is apparent when it is remembered that it took place before the day of assestherics. A period at King's College, London, and at Trinity College, Cambridge, completed the young man's accendenced education. At Cambridges much of his energy was devoted to mathematics, with the application of which to biology the

completed the young man's academical education. At or in Cambridge much of his energy was devoted to matequaties, with the application of which to biology the same of Francis Caliton will be frower picology linked. It was intended that he should receive a part of his trigating abroad, and for this purpose he was sent to study at these the frances German chemist the Licklet. But, his work thay eld pot seem to proceed trey resuch is his settisfaction, and he made a rather long that the same of the setting of the setting of the part of the setting of the setting of the setting of part of the setting of t

significant, for among Sir Francis Galton's great achievements are his geographical travels and explorations in Egypt and the Soudan (1844 and 1991) and Western South Africa (1850). The latter was undertaken under the auspices of the Reyal Geographical Society, but inanced by Galton himself. In acknowledgment of the personal services rendered by him in these plomes advanced into the dark continent, the explorer received his first official distinction, the Gold Medal of the Royal Geographical Society (1867).

The greater part of Galton's life, however, was spent in the prosecution of his various anthropological studies. These originated with his inquiries into heroditary gantus, but led indirectly to a number of separate problems and results. Some of these have become familiar to the general public, though their casociation with Galton is less well-known. Thus it is he who introduced into general use in Engiand the system of identification by 'thumb prints' (origination).

SIR FRANCIS GALTON, F.R.S. Born February 18th, 1888, died January 18th, 1911.

insted by Sir William Herschol), after working out with great those the details necessary for its success fal use. To him also is due the method of producing "composite photographs" of a type of individuals, such as members of one family, or a collection of portraits of crimnals, so as to bring out the characteristic features common to the group. But there can be little doubt that of all the creations of this fertile and broadspirited mind, the greatest gift from him to humanity is that branch of sclence—we are inclined to say that scientific creed—to which its author has applied the name "engenies." In the Minutes of the University of London eugenies is defined as "the study of agencies under social control that may funyeove or impair the racial qualities of future generations, either physically or mentally."

One conclusion which is brought home with great force by such studies in he—tity as Gaiton pursued is the immense force for good or for evil of a man's ancestry, and the opportunities, hitherto as nilther heeded, of improving our race by proper attention to these facts. This is the bright side of the picture, its dark side frowns down upon us when we consider how, under present condition, types of lower value to the community contribute a full quotent to the new generation, while the best types are through various irrumstances offen the less productive. And, most serious of all, the degenerate and positively vicious elements are allowed to polson the community with their fainted offspring, a miserable throng of individuals, who through no fault of their own enter life hissand from their vary englishes with and involved.

To the control of the

The curente laboratory founded and endowed by him at London University must in his mind have been destined not only as a scientific workshop, from which shall be turned out a collection of facts, but as the central organ from which shall be infused into the community a spirit of new wisdom, so

community a spirit of new Misdom, so oducating popular opinion that a mesal-tume offending the principles of eugenics shall come to be placed under the same taboo which in our day guards the bounds of social caste from smilar inroads

A great mind, a generous soul, a liberal hand- of these the world is bereft in the death of Sir Frances Galton — But his work remains and shall hear fruit to generations yet unborn.

Wrecking a Bridge by Electricity O NE of the most ingenious uses to which electricity was ever put was in the wrecking of a bridge over the Wabash in

This bridge had been purchased by the county authorities, who intended to replace if by a steel structure erected on the old plets and abutments. The owner agreed to remove the bridge in thriv days. The task proved much greater than had been and spated, but it was successfully accomipated, but it was successfully accom-

The chief difficulty lay in the short time agreed upon for the removal of the bridge Several wreckers to whom the matter was submitted declared that it would be impossible within thirty days to pull down the old beldge without thinty the beldge.

bridge without lujury to the piers.

The structure might be blown up with dynamic, but the explosion would also destroy the piers. Were it fired, the heat would excake and hijvaire the masonry of the bridge. The thirty days expired, and an extension of one week was granted. The owner was at his wite end, when he chanced upon an electrician who proposed, not to blow up the bridge, but to burn it spart. He proposal was giadly accepted. Each span of the bride was composed of nine chords of three three was composed of nine chords of three three cut simultaneously, so that the span would drop between the piers into the tire. The cutting was to be accomplished by burn ing through the wood with loops of fron reastance made red-iot by the passage of the

chetric current.
The job was begin. Flity-four resistance loops were heated to wreck each span, and the spans were wrecked one at a time. Sufficient current was used to heat the iron wires cherry-red. The result was cauchly the same with every span. Between the turning on of the current and the fall of the span an hour and forty minutes elapsed. Then the mass of timbers fell into the water well inside the piers, so that they were unitipred.

The cut made by the hot wire was sharp and clean, and the wood was not charred more than an inch from the place of fracture

The whole operation took but a few homs. The current was first turned on at about five o'clock in the morning, and at two in the afternoon the last span crashed down to the river-bed.

Hydrocyanic Acid Gas Fumigation.

THE Bureau of Entomology has been of great service to the citrus fruit growers of California and Florida by Investigating hydrogyanic and gas tunnigation. In the former State the work has been directed against the scale insects, while in Florida the efforts have been directed against the white fly. Much attention has been given to various spraying methods,

A Nantucket Windmill of 1746 Still in Operation

How a Yankee Sailor Introduced the Dutch Windmill Into New England

By Allen Day

THE island of Nantucket is a ministure Holland in the number of its windmills. There are several types, ranging from old-time water lifters to the modern air motor, for there is not a creek or even a rivulet on the island, and the people must depend on rain falling on the roofs of their homes and

the corn—the only grain that will grow on the island—into meal. It is probably the oldest windmill in actual operation in America. It was completed in 1746, and with the exception of a few years, has been grinding corn since that time—185 years. The idea that the air current could be used for power for grinding grain occurred to Nathan Wilbur, a Nantucket sailor. He had

ing grain occurred to Nathan Wilbur, a Nantucket sailor. He had
visited Holland, which is windswept similar to Nantucket, and saw
the canvas wings forced by the wind,
awing lumber, as well as converting grain into food products. When
Wilbur told of his plan, he Nantucket people ridiculed it, but he was
not discouraged, and decided to
build the mill himself. On the isiand coast many shipwrecks have
occurred. The oaken beams
was he da shore furnished material
for the framework, while deck planking of white oak, still as tough and
firm as when pinned into the vessel,
was available for the exterior.

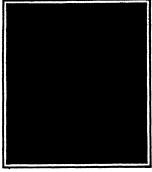
One of the oddest features of this curious old mill is the way in which man aids the wind in its operation. While the air currents sweep over the island as steadily as over the sea, since it is 30 miles from the nearest shore, the breeze or the gale may continue from thirty-six to forty-eight hours without diminishing in force-enough to move the wings of the great wind wheel at power But Wilbur thought of the days when the breeze was light, and when it might be necessary to run the mills continually to supply the demand for meal. His marine experience brought to his mind the idea of the capstan, which allows merely one man to exert a force that far excels his unaided strength. But the capstan was used for raising anchors, tightening ship cables—how could it be used for a corn mill?

without hought it over, and evolved a plan which was as ingonious as it proved to be practical. While, as stated, his neighbors had at first ridiculed the scheme of building the mill, they began to have more fath in him as they understood his plans more clearly. Then he told them that he could aid the wind in grinding by turning a spar attached to a capstan on the ground. With the help by turning a spar attached to a capstan on the ground. With the help of teams of his neighbors, an old spruce mast among the wreckage that had drifted on the coast was hauled to the mill site. The upper and was fitted with a rim of hick-ory cog teeth, and the lower end set into the hub of a wheel. The cog ond was fitted into the rim of what the railroad man would call the driving wheel, which moved the upper grindstone.

Wilbur cut and shaped the ship timber with a kit of tools brought from England. Piece by piece the framework rose from the ground. Its shape was octagonal. Nails

were too expensive for fastening, and servers and boils were unknown. So every part of the framework and boils were unknown. So every part of the framework held together by plus of hickory wood driven with a hammer through holes cut in the timbers. Although the mill from the roof to the ground is fifty free high, Wilbur designed and constructed every part of it, except the grindstone shart, and assembled the various parts. Quly when he was ready to set the "machinary" and grind-tones in place did he have help. The material for the upper portion was hapide up piece by means of a rope and a pulley fastened to the top of a wooden beam set firmly in the ground. In this way he placed the pleces in position without

ner and. What the construction of this curious mill meant in time and labor may be realised when it is stated that the spar alone is 50 fact in length, 12 inches in diameter at the top, tapering to 6 inches where it is set into the wheel which is turned by the capatan. The four wings or arms of the wind wheel driven by the wind are each 30 feet in length, having a maximum

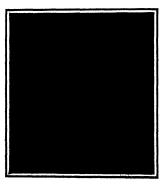


The shaft which is operated by the windmill.

It has never been repaired although in operation over 150 years. The shaft was cut out of oak, and all fron, including the shaft end that fits into the stones, was brought from Great Britain.

width of 6 feet. They are covered with sail duck lashed to the framework with tarred cord running through brass eyelets in the cloth. The interior mechanism of the mill is remarkable

The interior mechanism of the mill is remarkable from an engineering standpoint. What might be termed a "driving wheel" is set in the top of the mill. It is also made entiroly of oak. There are no



Interior of mill, showing stones for grinding corn; how they are turned by wooden cogn; also the rim of the great wooden wheel into which the sogn fit to cause the stones to turn.

apotes, as the wheel is solid, planks an inch in thickness extending from the hub to the rim. The rim itself is no less than a foot square in thickness, compessed of sactions cut into concave shaps, so that the whole form a circle which is 11 feet in dismeter. The sections of the rim are also held tightly by wooden juis, and the exterior of the rim is overed with a band of iron, taken from a wrecked skip. Projecting from the Inside of the wheel rim are wooden cogn. These intersect another set of hibstury reach each three inches in height, which are wedged into the vertical shaft that revolves the upper giral-store. Consequently, as the division is proposed type, also targe the shaft, shoch is the proposed type.



Stone brake by which speed of mill is increased and decreased by a box loaded with stone set on a controller beam and operated by a pulley.



Exterior view of mill, showing wings driven by wind and the spar which is actuated by the capstan.

The wings me not covered as mill has consed operations temporarily.

collected in claterus, or upon hand force pumps or air power for drawing water. Some of the more enterprising farmers have tanks at a height of Grty to fifty feet above the ground supported by steel lattice towers. The ocean winds blowing over Nantucket create an air current which often blows at the rate of thirly nites an hour, and thus the underground water is pumped into the tanks. Piping extending to the ground, thence to the fields and gardens, forms a little irrigation area, while the force is enough to surinkly lawns and flower beds and to furnish water for washing and other domestic purposes.

But the most interesting industry in Nantucket is a grain mill operated by wind assisted by "man power." It is the last of three that actually turned

Two Interesting New French Aeroplanes

The De Pishof and Paulhan Machines

THE DE PISHOF MONOPLANS

THE new monoplane of Mons, De Pishof resembles in its general outline the No. XII. mono piane of Bleriot, but it is a somewhat lighter and more powerful machine and it has a number of novel points. Above the two skids, which are suspended from the axle connecting the front wheels by means of rubber bands, there is a platform or frame containing the motor, radiator, and twin seats for the pilot and passenger. The single plane extends completely across the machine above the motor and aviator and carries a torpedo-shaped gasoline tank eve it. It is suitably stayed above and below by the usual guys of steel cable and steel tape. rear ends of the skids are extended back and upward to meet at their rear extremities downwardly inclined rods extending from a socket on the hub of the propeller (which in this case is placed back of the plane). On an upwardly-curved arm at the end of the frame thus formed is mounted a tail like that used on the Blériot monoplane. Below the frame are two small skids, one on each side. Twin vertical rudders are fitted above the tail, and a small but rather long horizontal fin extends from the center of the tall forward five or six feet. This machine dif-fers from the Bletict XII monoplane chiefly in hav-ing the propeller placed back of the plane instead of in front of it and also in the use of skids and fram ing resembling the Farman biplane. The motor is provided with a starting crank in front, and the the front of the machine almost the appearance of an automobile. The resemblance is further borne out by the use of a leather-lined cone clutch, which onnects the motor with a shaft extending back early to the propeller. A sprocket at the rear end of this shaft drives another sprocket on the hub of the propeller by means of a chain. The propeller is of large diameter (9 feet) and it drives the machine at igh speed (85 kilometers, or 52.8 miles an hour) The motor used is a four-cylinder Austrian Daimler motor of 60 to 70 horse-power. The possibility of starting this motor with the clutch thrown out, as in an automobile, is found advantageous when the machine descends in the open country and help is not obtainable The control lever is placed at the right hand of the pilot and it operates the horizontal rudders and warping by fore-and-aft and by side motion Steering is accomplished by the The dimensions of the monoplane surface are 3 by 9 meters (984 by 295 feet), and the supporting surface is 27 square meters (290.8 square feet). The over-all length is 9.5 meters (31.2 feweight of the monoplane complete is 360 kilogrammes (783.7 pounds) This is light compared with the Blériot, XII, which had an eight-cylinder V-type motor (the E. N. V.) of about the same horse-power as De Pishof's monoplane, but which was evid heavier engine. A description of the Biériot XII., and of Claude Grahame-White's experience in learning to fly it, will be found in Supplement No. 1782.

THE NEW PAULHAN BIPLANE,

A short time ago we illustrated the hydro-aeroplane of M. Fabre This machine was of novel construction, having wings with dotachable cloth and ribs that could readily be taken apart and folded when

The Paulhan biplane, illustrated herewith, is constructed upon the same system as the monoplane of

M. Fabre. The illustrations of this machine below give a good idea of its appearance and construction. The main plan upon which this biplane is built is similar to that used by Glonn Curriss with his biplanes. There is a central section containing the motor and aviator's seat, and the outer sections are attached to this central section in a novel manner

The planes of the Paulhan machine are built upon a form of trussed girder made up of two long, thin,



The automobile-like De Pishof monoplane viewed



De Pishof's passenger-carrying monoplane in flight,

sah planks about 8 inches wide at their center part and ¼ inch thick. These planks are spaced about 8 inches apart and the lower one curves upward toward its ends until it meets the upper one. These two planks are tied together by flat steel plates forming a series of V's and thus giving a very rigid trussed girder that makes unnecessary the use of man gaves. The ribs are attached to the lower members of these main girders by means of clamps passing over an armored wood fillet that hes within the base of every other V. The ribs are out out of solid wood and are arched to the proper curve. The cloth is provided with pockets which enable if to be slipped on the ribs and laced in place. As the ribs are attached to the girders at their front ends only, they have a certain amount of spring or flexibility that, it is claimed, gives the machine automatic stability.

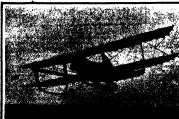
Both the upper and lower girders are divided into sections and connected by uprights. The uprights of adjoining sections are placed side by side and fastened together by S-shaped leather straps which wrap around them and are drawn taut by a special tightener. Leather strans are also used to connect the uprights of the center cell to the chassis as well as in most other parts of the modiline where joints must be made. This use of leather for ioints, it would assem, is a good idea, as leather is very tough and attong material. By using it the piercing of holes in the strate is rendered unnecessary.

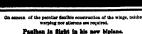
There are two long trussed girders running from in front of the lower plane out to the rear, where they support the single-surface tail and the vertical rudder in front of it, while at the front they carry the mono-plane horizontal rudder, or elevator. The motor is on a frame back of the pilot's seat, which is forcation a torpiedo-shaped aluminium car secured to the lower plane simply by crossed gavy wires that run through a large gasoline tank just back of the pilot's and passenger's seats, which are in tandem. The aluminium car is used to reduce all resistance and protect the aviator. The forcand-aft girders have their subsection of the subsection of the subsection of the subsection of the machine is mounted upon two skids being carried upon a pair of menunatic-tired wheels converted together by a short axie which is attached to the skid by a rubber band and is guyed both fore and aft to keep it from twisting.

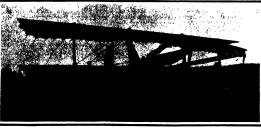
In place of the single control lever to which be as become accustomed in piloting the Farman manas be once accustomed in photing the Farman ma-chine, Paulhan makes use of a vertical steeling wheel like that used by Cartiss Pushing or pulling on this wheel turns the horizontal rudder downward or upward, while turning the wheel operates the vertical rudder at the rear. No warping of the wings or other device for correcting side tipping was shown on this machine when it was exhibited at the recent Paris show, and it is claimed that the flexible ribs in connection with the zig-zag girder construction (which resembles the cells of Dr Bell's tetrahedral kites) give the machine sufficient transverse stability to make any of these devices unnecessary of the great claims for this new machine is the case and rapidity with which it can be assembled or disassembled The end cells may be detached by undoing three bolts at the top and bottom of the uprights—an operation which takes only a minute or two at the outside—and the whole machine can be taken apart and packed in a small case 15½ feet long by 3½ feet square within an hour. The ready detachability of the end cells makes it possible to accardability of the end cells makes it possible to store the machine in an ordinary shed, as the total spread is 38 feet, which is reduced to 12 or 15 feet when the end cells are removed. The fore-and-aft length of this new biplane is 25% feet and including the horizontal rudder and the tail, the total lifting surface is 300 square feet. The weight of the machine is 800 pounds, which is not great consider-ing its size and rather heavy construction. As the photograph shows, the Paulhan biplane appears to be an excellent fiver Aviator Paulhan has opened a school at St Cyr, and several pupils have already

learned to fly this new machine
The chief advantages claimed by M. Fabre for his
system are (1) great strength and rigidity, (2) small
head resistance; (3) the non-use of trussing wires
with their liability to loosen or break and with their
considerable head resistance; (4) automatic trans-

(Continued on page 99.)







Paulhan is scated in the aluminium car and leaning forward. His padded aviator's believe shows above one of the guys,

The second of the second secon

Correspondence

Cost of the Winton Car

To the Editor of the SCIENTIFIC AMERICAN in your issue of January 14th, 1911, appe lustration of our 1911 touring car You have published the price of this car as \$4,250 This price should be \$3,000

THE WINTON MOTOR CAR COMPANY.
W J Ward, Advertising Departme Ward, Advertising Department.

Cleveland Ohio.

The Old Engineer Corps of the Navy

To the Editor of the SCIENTIFIC AMERICAN

The report that reciprocating engines, and not tur bines, are to be used on naval vessels may perhaps be accounted for on the theory that the jack-of-all trades idea as to navy officers, introduced by the act of idea as to navy omeway, introducing by the personnel act of 1899, is bearing its legitimate fruits in producing men of mediorre attainments as jacks-of-all-trades, but who might, on the theory of each man to his calling (special line where he excels), have given us great engineers, tacticians, gunnery officers, or whatever might have been the best in the man. I have, therefore, taken the trouble to ascertain what has become of the old engineer corps of the navy. including in my calculations only such as were gradu-ated as cadet engineers, and who therefore were taught steam engineering as a sole profession. Of the 135 men so graduated at Annapolis, 35 were dead in 1908 (the date of my latest information as to the old engineers), 27 were on the retired list of the navy, 36 had resigned from the navy to enter civil callings, and 37 were on the active list of the navy Assuming that the men who stand highest in their re, on the whole, the men best qualified for their calling, and confining the count to the highest five men in each class tone class has but three members), the count shows !! dead, 4 retired, 15 resignations, and 13 still in the service on the active list ose counted as resignations were all alive in 1908 each case USNA (Line) in each case

Death in Too Steep a Descent

To the Editor of the SCIENTIFIC AMPRICAN

The recent sad fatalities to my friends Mr Arch. Hoxaey and Mr Ralph Johnstone prompts me to address you in view of giving my opinion as to their cause, especially in view of the fact no theory has been advanced among the skilled in the science of nerodynamics that locates convincingly the direct cause of these disasters, to say nothing of that which befell Mr Moisant and some others before him

An aeroplane in flight, with its nose dipped to ward the earth, at an inclination at which it no longer retains an angle of incidence toward the line of descent, and wherein the center of pressure is en-tirely gone from under the main plane, eventually by gravity—develops such terrific speed that "be-comes impossible to again right the machine, the small area of surface on the horizontal control being inadequate to counteract the tremendous pressure now exerting its full force upon greater area of exposed surface, namely, that running along the main plane on top, near its leading edge

I am of the opinion the extremely daring aviator, desiring to execute a sensational, rapid glide toward the earth while in flight, or while performing a spiral dip, likewise the aviator who makes too quick a landing, unconsciously allow the center of pressure under the planes to remain at zero for far too long a period For, after executing either of the above-mentionel per formances, he has dipped the nose of his machine so steeply toward the earth that the aeropiane no longer angle of incidence toward the line descent, and the great head-on pressure due to the descript, and the great man on pressure dut to the terrific speed the forces of gravity have brought about, is now directed against and on top of the forward edge of the main plane. This air pressure acts ward edge of the main plane Inis air pressure sees against and on top of the parabola of the curved surface of the plane situated immediately back of the leading edge Eventually the pilot pulls at his levers in an endeavor to bring the machine to an even keel, in an endeavor to bring the machine to an even keel, only to find that the area of surface on the horizontal control is now insufficient to counteract the head-on pressure directed against the top edge of the main plane. The latter offers an area of surface to this head-on pressure many times in excess of that pos ed by the horizontal control, and so the aviator is engrapped to his doom.

As it is not considered practical, by many, to increase the surface of the horizontal control, may I suggest the advisability of encouraging inventors to produce a safety stop, to be put in use on the control levers of aeroplanes, that will prevent flying up or own beyond a certain safe angle. New York, N. Y.

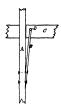
Wood Bending in Nature.

To the Editor of the SCIENTIFIC AMERICAN:

In the November 12th, 1910, issue of the Scientific American you state that the chief objection to the of wing warping in aeroplaness is that the spare are weakened by the constant bending I have read several articles to the same effect in current seronau tical journals.

A good instance of the abuse which a good piece wood will stand without distress is found in raisin-stemming plants Below I show diagram of s part of a raisin grader

A is a stationary post, B a hickory strip, % by 4 inches, bolted solid at bottom to post and fitted a pivot joint at D, upon which shuffling box C weighing 250 pounds is mounted. The box C, and consequently the upper end of B, move back and forth a distance of 4 inches at 300 strokes per minute. Thus a length of 30-inch B is flexed back and forth 2 inches each side of normal position. These machines



are run continuously for ten or more hours per day about two months each year, and the strips B for years It would be impossible to subject an last for years seronlane suar to the shuse which these sticks stand without distress, and so it would seem that the injury in the case of the former was greatly exaggerated. etonia, Cal.

The Mirror Problem

To the Editor of the SCIENTIFIC AMERICAN

The "Mirror Problem" submitted by Mr. Carl Herring, of Philadelphia, Pa , and published in your issue of December 24th, 1910, contains nothing of mystery whatever, and should offer no difficulty to one who gives it a moment's consideration. The question, "Why does a mirror reverse right and left, and not up and is, in fact, a false statement of the propo sition: for while the mirror does not actually reverse horizontally or vertically, it does reverse tically just as much as it does horizontally. The mir ws only such reversal as has already given to the object reflected. In placing a book before a mirror, the page is of necessity reversed from the position in which it may be read by the eye, and the appearance of the reading matter in the mirror de pends wholly upon the manner of the reversal. It the book has been turned side for side, then the re al will be from right to left, but if the reversal has been top for bottom, then the letters will appear in their usual order, but upside down reversal by the mirror depends upon the fact that it really does nothing of the sort, but gives back just what it receives. That this is true may be made very apparent if printing upon a transparent sheet be held before the mirror, when, weether normal or reversed, it will readily be seen how accurately the image conforms to the object before it.

The reason, of course, why the image in a corner The reason, or course, why the image in a corner between the two mirrors does not appear reversed, is that it is a secondary image, reflected from the other mirror, and because it was reversed in the first glass, must necessarily be in normal position when given to the second, because in this the eye sees it from the

Another, and perhaps an easier, method for some to understand, of explaining this matter, is through its analogy to the process of printing from types When the type comes in contact with the paper, it is easily understood that the image which it leaves must be identical with that of the face of the type, yet when we look rt the type itself, it appears in reverse. The reason of this is that we see the type from the wrong side. If the type body were transparent, and we should look down through it to the face of the type in the act of printing, the letters would appear normal; but when we lift the type and reverse it so as to look directly at the printing surface, then the letters makerally take the reverse position. It is, all The reason of this is that we see the type from the

a question of which side we took at the object from, both in the printing and the image in the mirror, for in holding a printed page up before a mirror, we have already reversed the position, and as the mirror gives back exactly what it receives, we get exactly the same view of the printing as if we looked at it through the back of the sheet.

Mount Carmel, Ill.

[We have received a flood of interesting replies to the Mirror Problem, but lack of space prevents us from publishing more than one of them.—ED.]

Relative Strength of the World's Navies in Armored Ships

To the Editor of the SCIENTIFIC AMERICAN:

The annual statement from Washington giving the standing of the world's navies appeared recently in the newspapers placing the United States in second place; and almost at the same time there was pub-lished a dispatch from Berlin which stated that the United States would not be in second place if the obso te vessels had been left out of the standing. In the first place, both tables were reckoned according to e, which is very misleading, as a nation's n strength depends entirely on her armored ships.

While it is true that Germany will be in second place
in a year or two, due to her greater activity in building dreadnoughts, she is not in that piace now, as the following table will show. Germany, in her anxiety to throw out the obsolete American battleships, forgot that she as well as other nations has old ships contemporary with ours which also must be left out. To make this clear, I have separated the column under "battleships" into "modern" and "old," as well as the dreadnought column into "dreadnought battleships" and "dreadnought cruisers." Thus it will be that while Germany apparently surpasses the United States in dreadnoughts, i. e., 17 to 10, such is not the case at the present time, each nation having but four in commission. On the other hand, the su-periority of the United States in "modern" battleships is evident; and what is more to the point, Germany has one more "old" battleship than the United States

THE WORLD'S NAVIES, BUILT OR BUILDING, 1911.

Country,	Number of Dreadneughts,		Number of Battleships,		Number of Crainer
	Battleships	('rulears.	Modern.	Ol4.	Amnored,
Great Britain. United States. Gormany. France Japan. Rinssia. Italy. Austria. Argentina Brazii Spain	15 10 18 8 5 4 4 4 4 8 8	5 9 4 0 9 0 0 0	40 16 30 18 10 10 10 10 0 0	11 9 10 5 1 5 0 0	34 15† 9 16 18 8 11 4 0

Including 6 " Dantons," as per the foreign statistics,
 Including 3 "Charlestons," as per the foreign statistics

The "old" battleships of each country in the above table and the total number of armored ships are as

follows:	•			
	Class			
Great Britain	··· "Canonus"			
	"Renown"			
	"Bwiftsure"			
United States	"Alabama"			
	"Kentucky"			
	"Iowa"			
	"Indiana"			
Germany	"Mecklenburg"			
	"Kaiser Wilhelm II."			
France				
2 tance	"Gaulois"			
Japan				
onpost	"Ringue"			
Russia				
TOTAL NUMBER OF A				
Great Britain				
United States	50			
Germany	46			
France				
Japan,	81			
Russian	37			
Italy				
Austria				
Austria				
	8			

By the above list it will also be seen that even a year and a half from now the United States will surpass Germany in total armored skips by four, but her superiority in dreadnoughts will, of coppes, land, German untily in second place.

The Rescue of a Sunken German Submarine

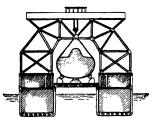
How the "U.3" was Raised by a Special Floating Dock Built for that Purpose

ALTHOUGH submarine navigation is admittedly A dangerous, it will come with a shock of sur-prise to many people to learn that during the past ten years, according to recently published statistics, the lives of 129 officers and men have been lost in some twenty serious accidents which have occurred, all of them during peace maneuvers. Most of these fatalities might have been prevented had there been at hand, or within reasonable distance, the proper appliances for quickly locating the sunken vessel and raising her to the surface. It was only in connection resemp set to the surface. It was only in connection with the latest accident, which occurred to a German submarine, that a suitable salvage plant was available; and it proved its efficiency by raising the vessel within three hours after reaching the scene of the

Of the submarine accidents above referred to, occurred in the French navy, with a loss of 54 lives, five in the English navy, with a loss of 28 lives; two occurred to Russian submarines, with a loss of 21 lives; one Japanese accident occasioned the loss 14 lives; Italy in one accident lost 8 men; and the United States in four accidents has been so fortunate as to lose no lives

speedy raising of the German submarine "U 3." which sank in the harbor at Kiel, was due to the possession by the Germans of a sea-going, salvage dock, capable of navigating under its own steam, which was built expressly for the raising and docking of sunker This vessel, the "Vulcan,"

on our front page in the act of raising the "U.3," is a double-hull vessel, 230 feet in length, with a lifting capacity of 500 tons. The width between the two hulls is sufficient to admit with good clear



s-section of the "Vulcan," showing a subms lifted by the gantry crane and placed upon the removable floor of the dock.

ance the largest submarines. At a suitable height a shelf is formed along each wall of the interior open-ing, and upon this rests the removable floor of the The two hulls of the ship are each built with watertight compartments of large capacity, similar to those which are found in the side walls of the ordinary floating dock When a sunken submarine is to be raised, the "Vulcan" steams to the wreck, and is moored securely in position above it Spanning the well between the two hulls are two massive gantry cranes, each provided with heavy lifting tackle driven by electric motors The first operation is to fill the compartments until the vessel has sunk to the required depth. The floor of the dock is then moved clear of the well. The lifting tackles are now low ered and made fast, either to chains which have been slung around the body of the submarine, or to two we eye-bolts which are permanently riveted into the submarine's hull. At the order to hoist away. the submarine is lifted free from the mud and drawn up within the well, until its bottom is clear of the supporting shelves on the inner faces of the two hulls, above referred to. The dock floor is then placed in position upon the shelves; the water is pumped out of the two hulfs, and the "Vulcan" rises, lifting in p the submarine and the dock floor clear of the wat

ere is some confusi on in the accounts which have been cabled over regarding the loss and salvage of submarine "U.3." As soon as the accident occurred. the crew released a spherical buoy containing tele arrtus, which rose to the surface, uncoiling its wires, the lower ends of which were attached to the half and led to a telephone within the vessel. By this means the captain of the "U.3" was able to siente with the surface; and he reported that communicate with the surface; and he reported that the yeasis had, a forty-cipit hours supply of oxygen, and that the crew were in no immediate danger. When were at once dispatched for the "Vulcan" to the crew of the dispatch, According to

one report, a floating crane, pending the arrival of the "Vulcan," succeeded in lifting the bow of the submarine sufficiently for twenty seven of the crew to escape through the torpedo discharge tube the cap tain and two lieutenants electing to remain in the conning tower until the arrival of the "Vulcan". The breaking of a ventilator, however, and the subsequent flooding of the vessel, unfortunately proved fatal to the three officers. On the arrival of the "Vulcan."

time the vessel appeared above the surface.
The "U3" was built at Danzig in 1909. She displaces 300 tons, and is of the submersible, as against the true submarine type. The hull proper is circular in cross section, but she is provided with a deck which extends the full width of the vessel and is rounded down to connect with the circular shell end-on view of these vessels, therefore, gives them a flattened U-section. In November last, in company with submarine "U4," the "U.3" made the passage from Cuxhaven around the Skaw to Kiel, a dis tance of 540 miles, in about forty hours, the journey being made without any convoy

Climatological Returns from the **British Colonies**

THE English Meteorological Office has earned the gratitude of meteorologists, climatologists, geographers, and medical men by undertaking to place at the disposal of the scientific world the meteorological observations made in the British crown colonies and protectorates, which have heretofore been merely filed in manuscript at the Meteorological Office, or Books of the Colonial Office Information concerning the climate of these colonies a most important matter to prospective settlers—has been extremely

In 1907 the director of the Meteorological Offic prepared instructions as to organizing and publishing meteorological observations, and these were widely circulated in the colonies in question, through the Colonial Office The form of publication in the Bine Books has been much improved in consequence, and arrangements have now been made to print off addi-tional copies of these meteorological records, which the Meteorological Office will distribute to appropriate institutions throughout the Office will also publish and distribute summaries of the meteorological returns that if receives in manu-script from many distant parts of the world

Among the places from which data are available Gibraltar, Cape Spartel, Falkland Islands, St Helens South Georgia, Suva (Fiji), Fanning Island, Maiden Island, and Ocean Island

Forest and Field as Hospitals

N general the treatment of disease among primitive races resembles the healing by prayer and faith, and other superstitious practices, which are not un-known in civilized countries, but most savages improve upon our miraculous healers by isolating the Experience has taught them the danger infection but the isolation of the nation, is prompted. by this danger, but by the belief that the sui ferer is possessed by a demon, as certain European farer is possessed by a denion, as certain European sects still believe to be the case with the insane Vari ous methods of expelling the demon are practised One is especially interesting because of its resumblance to a method, mentioned in the Bible and practised by our forefathers, which is always erroneously intereted. Diseased persons were placed outside the tree of the city, not to prevent infection, which was rather promoted by placing the patient exactly where traffic was most congested, but to facilitate cure by the patron deities which, in all popular beliefs, sit at the gate of the house, the city, or the state. In central Sumatra lepers are driven from the village to a forest, "to besech the gods of mountain and forest to cure them." In many districts huts are built in forest for the sufferers. The natives of the island of Nias, in epidemics, compel the sick to go out an open field, where a shed is erected to shelter them

The Current Supplement

THE current Supplement, No 1830, opens with an article by Prof. Joseph W. Richards, entitled "What Electrochemistry is Accomplishing"—Many initors have devoted time and brain work to the perfection of means for manufacturing rolled beams, and of later years, more particularly to the manufacture of so-called "H" beams M1 G E Moore reviews recent practice tollowed in the manufacture of these rolled "H" beams - Some excellent formula are given for obtaining various zinc finishes. An interesting Mexican forest railway is described by Mr. A. Reiche—Sir Joseph. J. Thompson's presidental address to the Junior Institution of Engineers, dealing with the rela tion of pure science to engineering, is summarized An analysis of Joseph's Bruckers scheme for cross-ing the Atlantic in an airship is presented "Very curious and singularly interesting are the compara-tively little known details of the origin and progress of the rite of deflication or consecration which st one time obtained so extensively for the Caesars Mr P F Mottelay discusses this rite on the basis of some recent discoveries that have been made by one of the prominent members of the French Academy of

Mimicry with the Mimic Left Out

By Benjamin C. Gruenberg

THE doctrine of "natural selection," particularly as it has been applied by some of its friends in the interpretation of certain special phenomena of nature, is receiving a great deal of adverse criticism not only from experimental botanists and zoologists, not only from ever timental obtaineds and zoologists, but also from competent field naturalists. The theory of "Mimicry" has supplied material for much controversy, but until recent vests most of this has been of a speculative character since there had not been gathered enough toes to watrant any conclusions one way or the other. The theory itself is tasemating enough, and has been quite satisfactory to the uncritical lovers of nature

There are known many cases of truly remarkable resemblance between species of animals belonging to totally different families. The most common example in this country is that of the resemblance between the 'Monarch butterfly and the 'Viceroy' This curious relation was first pointed out by Bates, from his studies in tropical America, it was independently discovered by Wallace in tropical Asia and in the Mulay archipelago, and since observed by many stu-dents in all parts of the world. Wallace has given the best statement of the general facts which are essentially as follows

1 The two species always occupy the same area

- and inhabit the same kind of stations
 2 One of the two (the 'mimic") is always more
- defenseless than the other The mimic is always less numerous than the
- mimicked species The mimics differ considerably from the bulk
- of the species in their own family

5 The resemblance is always superficial, and ex-tends only to such characters as are concerned with the general appearance. Under these conditions it is very easy to believe that the more defenseless species derives certain advantages, in the sense of motection against common enemies, from its resemblance to better defined species. And according to the doctrine of natural selection if applied to these resemblances, the resemblance is the result of the gradual elimina tion of those individuals among the ancestors of the 'mimic" group who least resembled the "models

The most recent contribution to a knowledge of the actual facts is that of R C Punnett Professor of Biology at Cambridge University who spent the of 1909 in the island of Cevion making a special study of the whole problem. In Ceylon there are many good examples of "miniery," and the

conditions for study were very favorable. Prof. Punnett found that the 'models," which are supposed to derive their superior protection from a supposed to derive their superior protection from a combination of unpalsability and distinctive colora-tion, have not the identical distribution of the "minnies," which are supposed to derive their profrom their resemblance to the models. most the areas of distribution overlap. The common birds, which are supposed to be the agents of natural selection in the elimination of those forms that not sufficiently resemble the model, are rarely to attack any of the butterflies. On the other hand, the common lizards are very voracious, and destroy large numbers of butterfiles as well as of other insects, but by actual experiment it was found other insects, but by actual experiment it was found that the lizards make absolutely no discrimination between the supposedly "unpalatable" forms and the supposedly "unprotected" relatives of the mimics. The failure to discriminate was also observed in the only other serious enemy of these insects-a certain fly that attacks the butterflies, pierces the thorax (Continued on page 99.)

Control of the Santa Santa

Equilibrium and Rest Positions

The Mechanics of Keeping One's Balance and Being Comfortable

By A. A. Somerville

Fig. 180M the standpoint of mechanics alone, and aside from physiological reasons, a man is ordinarily in the most comfortable position when he is in the most stable equilibrium and for physiological reasons, and most relaxed Comfort in its relation to equilibrium implies liability to avoid failing. A body is probably in the most stable equilibrium when its height is a minimum, the area of its base a maximum, and a vertical line drawn from the center of the mass passes through the center of the base of the conclusion that many with the conditions and that is not infrequently the case of position for extreme relaxation. This brings out another idea, and that is not infrequently the case of position for extreme relaxation. This brings out another idea, and that is that one rests only when the muscles are relaxed. Part of the body may be rested at a time Such is the condition when one sits down in a chair. Such is also the case when one stands, bearing most of the weight of the body on one limb. Such a position also

complies fairly well with the definition of stable equilibrium, which is the principal thing to be established in this article For this purpose, several photographs have been made especially to fit the case, and other have been picked up that fill in admirably well.

To begin with, standing in a rest position betokens sociability rather than business. To this

To begin with, standing in a rest position brokens sociability rather than business. To this any military officer will testify Possibly it has been fixed by cateom, the most common libustration possible, that of a uniformed cadet at "Attention" and "At Rest," shows the idea. In the first case he is ready to "go." Here there is practically no relaxation whatever—all muscles tense; also perfectly erect, which implies that the center of gravity line falls directly between the feet or center of the base

In the second position, "As Real," most of the weight is thrown on one foot, the one in the rear, the other foot thrust forward, the body thrown only slightly forward, and the center of gravity line failing within or very near the rear foot A special picture has been made to show this by hanging a plumb line directly in front of a man so posed. The limb placed forward is almost wholly relaxed. However, if this position is held

very long, it becomes uncomfortable. It has been auggested that this position of rest is typified in the case of a tent pole and guy rope—one supports the weight, and the other is thrown around in any direction to balance any forces that may suddenly appear.

Note the case of a civilian (Fig. 4) in a place where he is not free to sit down, but leans instead, and he really forms a tripod When tired one frequently makes use of this third support. An aged person may use a cane, and not be lame in either limb, but the cane is used as a prop, and so enlarges the base of the amporting body. In this case it is not for resting, but rather for sublits, which indirectly leads to comfort.

Another habit which is restful in itself is that of leaning on a desk when writing, and also when eating, if the latter were only permissible in politic society. This is a case of making the elbows or arms support part of the body, or really broadening the base of support

In reality, when one is standing erect, his form is very much like that of a top ainding on a point. Fig 5 shows that the base is really very small. The statement has also been much that by crossing the limbs at the knees, as one sometimes does when not only the very dignified appearance, a so-sailed look is formed within the hip bones tending toward parkater stability. The latter and is possibly attainable, but not by any interlocking of the bones, as the pictules probably show. But, due to the Xor cross formed. If one tips either to the right or left, the center of mass of the body is lifted, which is concentre of mass of the body is lifted, which is con-

trary to the law of gravity, and there is a tendency

When a person expects a playful onlaught or stack, he braces himself or becomes more stable by placing the feet farther spart—note the common picture of the center on football team in action Sometime for greater stability or for a stronger brace the hands are placed on the knees to stiften the body, the action being the same as that of resting the arms upon the

This is carried to a still greater extreme by a man in a football line, where he crouches so low as to get both hands on the ground, and so has a minimum height and maximum base. The constant training a football line receives is to get low.

The track man starts from a crouching position, but this is for the purpose of preserving kinetic or moving rather than static equilibrium, for when crouched the body may be pushed shead, while due to its inertia one would topple over backward if he attempted to detained. The length of time during which the suspense continues depends entirely on the extent of the surprise or the lack of ease which is felt, which, of course is greater among strangers than friends.

Metals More Precious than Gold

I NASMUCH as it is the standard of currency, most persons seem to think that gold is the most precious of all the metals. This, however, is a mistaken notion. Indeed, the number of metals which, at the present time, are more valuable than gold, exceeds the number of those that are of less value.

The cheapest, but not the most plentiful of metals, is iron. In its class are lead, site, copper, areals, cite, mercury, alumninum, and nickel. In the next class, with reference to gold, we find antimony, cadmium, sodium, and bismuth. A sharp rise in the scale of prices intervenes between this class and the next approaching that of gold, i. e., that compris-

In g magnesium, manganese, tungsten, silver, thailum, and moirbdeaum, all of which are sold by the ounce, the prices varying quite a good deal. Then, in a class by itself, so to speak, comes chromium, a metal whose ores occur somewhat abundantly in the Shethand Islands, but which is difficult to procure in the free state.

At this point enters gold.
Of the metals more precious
than gold, there should first be
mentioned that peculiar one
known as platinum, found in
California, Canada, Strail, Austrails, on the siopes of the Ural
Mountains, an of siewebere.
Pictinum is said to be really an
alloy of the metals platinum,
polladium, irridum, osemium,
rhodium, and ruthenium, together
with a little gold and fron,
All these, save the last, are
rhoble metals. They do not tarnish in the air, and are not
soluble in any single acid.

The most plentiful metal occurring in native platinum is that from which it bakes its name. This is of a grayinh color, and, with one exception, is the heaviest substance known. Its fruing point is extremely high, and this proporty, together with its freedom from tarnish, readers it available for the manufacture of crucibles and other vessels required by scientized to withstand a very scientized to withstand a very

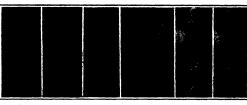
high temperature. It is also sometimes used as a substitute for gold in photography; and when deposited in a thin film on the interior of the tubes of tolescopes, it forms a dead-black surface that prevents the light from being reflected by the polished sides. The demand for platinum largely exceeds the supply; hence the metal is ever advanting in price.

hence cas metal is ever accessing in price.

Pallagitum is of a lustrous white color. It is the
most easily fused of the metals found in platinum
ore, and can even be volatilised. A curious quality
of this metal is that, when heated to redness, it is
porces to hydrogen gas, allowing it to pass through
somewhat in the same manner that blotting-paper
permits the passage of water. The allvery-white color
of palladium and its freedom from ternishing reader
it useful for making scales and division marks on
scientific instruments. A mixture of this metal with
moreoury is sometimes used in depairity.

Commun is a metal table possessee two remarkable

Osmium is a metal that possesses two remarkable properties. In the first blace, it is the most refractory of the metals, resisting fusion at the most intense heat, its lade the heaviest of the substances, being almost twenty-two and one-shalf times heavier than water. Together with iridium, it occurs principally in a possible variety of autive platians disaled possibilities are the substances of the properties of continuous or in that it contains a large proportion of continual distinutions of the substance of the substances of



Position at 2. Position 3. Plumb line 4. Leaning against 5. No arch 6. With legs attention. at rest. on one foot. a chair. here. crossed.



7. A crouching start.

EQUILIBRIUM AND REST POSITIONS

start running while in an upright position. After once started, however, the body may gradually be brought to a more nearly upright position, and now due to its own inertia it will be kept moving This crouching position is well shown in Fig. 7.

This crouching position is well shown in Fig. 7. The picture was made at a regular track meet, and was caught at such a time that the smoke of the starter's pistol is seen while the runners have not yet left their positions.

A different motion is brought out in the case of throwing. When a baseball player throws a ball, a twisting motion is used, what in mechanics is called a torque. He bears all the weight on one foot, and uses that foot as pivot about which he swings, using the other foot and limb as a fever to push himself around. It is much on the same principle as swinging a stone in a sing, except that without the sling the man simply pushes himself part way around by taking a step forward and around the other foot upon which he is standing.

Things to be noted then are these: One unconclously assumes a rest position; this is when most relayed and most stable. To withstant an attack, the nuncles become tense and the base broadened, their hands are made to support the body. This latter is easiest noted by "attacking" a man or surprising him. If one is suddenly stopped by souncine else when he least expects to be interrupted, but momentarily hrose blimself and assumes a position skin to that for defense. He then gradually shifts the weight to one foot, and reste while he is being

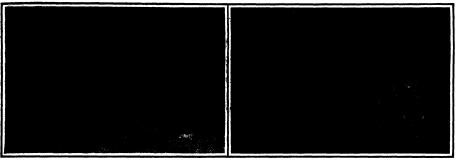
Some Typical Groups of American Aborigines

Scenes of Life and Customs Among the Natives of Our Hemisphere

By Randolph I. Geare

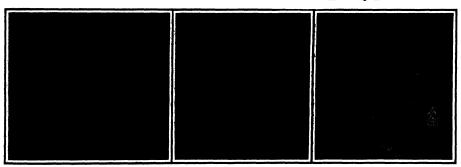
THE present article is intended to convey briefly I an idea of the appearance and chief characteristics of typical representatives of several of the most prominent stocks of American Indians.

The Eskimos of Smith Sound, northwestern Green-land, are the most northern inhabitants of the world "eaters of raw fissh." We all know in a general way Bands of these people winter as far nort; as istitude the Eskimos look like. They are of medium 79 degrees, and they have summer camps as high as



Eskimo family at Smith Sound in merriment at preparing to haul home a small seal.

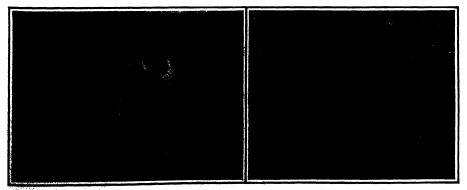
Sioux family group.---Man returning from the chase, girl beading a moceasin, and woman dressing a hide.



Western Eskimos. Woman in center clad in caribou skins; one to right in marmot skins; the man is dressed in caribou skins and holds a burbed harpoon.

Mexican and South American Indians.

Maya-Quiche Indians of Guatemala. On the left a Jivaro Indian; in center an Oaraca woman, on the right a Piro Indian, Once the most highly cultured of all nations of western hemisphere A family group.



Tehnolche Indians of Patagonia.

Cocopa group of Mexican Indians of Sonoran province. Young man teaching boy to shoot, woman pounding corn, and girl carrying baby.

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

A New Camera with "Full-Sight" View Finder

WHILE cameras with fixed focus or with a fo-cusing scale are popular with amateurs for work in which no very high standard of perfection is sought or attaine, it is generally admitted that the best results can be secured only by the use of a ground plass focusing acreen on which the view to a substantial can be secured in the till and focused him be photographed can be seen in full and focused by direct inspection of the image upon the screen. The use of this arrangement however brings with it an obvious disadvantage. It necessitates a series of steps such as focusing moving the focusing screen steps such as focusing moving the focusing screen away so as to admit the plate carrier insecting the latter setting the chaiter opening the plate acried, and only then is the camers ready for exposure. In many instan ess essocially in landscape work the dealy included the positive formation in the consequence. But on the other hand quite often it is indispensable to have the camera in readiness to make the exposure at a moments notice and in such cases a camera working on the usual direct focusing principle is inconvenient or even useless. Cameras have been constructed in which the image formed by the was cast by means of a mirror set at an angle within the camera upon a ground glass screen placed horizontally in the top of the camera. Cameras of this type however have a number of disadvantages russ type nower nave a number of disadvantages. They are voluminous expensive and in use must be held sufficiently low to enable the operator to look down on the focusing seen. The result of this last feature is an undestrable and unnatural perspective. There was therefore scope for the invention of an improved camera which should offer the advantages of direct vision focusing while avoiding the short of direct vision for using while avoiding the short comings of the mirror camera. An apparatus which areas to fulfill the necessary conditions is described by F. W. Oelje in Die Unachaw and its presented in our accompanying illustrations. It will be seen that the camera when folded up or cupies but as small volume. On the right hand side there is a silt volume. On the piate holder is inserted. The nilled head V is then turned whereby the plate holder is held fast in place. The body of the plate holder is then simply pulled out leaving the plate held in light frame in the earner. The plate is next lifted up out of the field of the lens by two turns of the milled head At the same time the focusing screen automatically advances into the place previously oc cupled by the plate so that the view becomes visible upon the ground glass the light being screened off by the shade L

The adjustment I the focus is most conveniently effected by adjusting, the position of the base strips D upon which the item holder is mounted this motion be ing-effected by means of the fore flager as indicated at P applied to a projection attended at a suitable point. After thus setting the focus which can be done very rapidly the camera is ready for making the exposure by pressing the knob A shown in Fig 2. This actuates the shutter pushes back the focusing screen and exposes the plate.

The camera has a number of additional new fea

ing of fish under water. In the interest of persons who are already possessors of other cancers and who may wish to avail themselves of the advantages of this new invention it may be mentioned that the essential paris can also be obtained separately in such form as to be adaptable to an existing camera. The advantages of this new departure in the field of pho



Fig. 1.—Front view, showing manner of focusing with index finger.



Fig. 2.—Rear view, displaying focusing screen.

NEW CAMERA WITH FULL-SIGHT VIEW FINDER

AND FOCUSING SCREEN

tography seem to commend themselves both to the amateur and the professional photographer, and it would seem that there should be quite a demand for cameras equipped with this full-sight" view finder and forusing screen

The Right and the Left Face

It is at the present day well known even to the lawrant that various functions of the brain are localised at dofinite points. This may become evident for example, if a particular portion of the brain becomes affected by disease accident, or under the knife of the operating surgeon or the experimental physiologist Some extraordinary derangements of the mind may arise in this way. Thus in certain diseased conditions a person may lose his power of speech, though fully retaining his under standing and the control of the nusuelar mechan

gently controlling certain of his actions Such a person, for example, when handed a speen, though perfectly aware of its proper purpose and use, many go through some such ridiculous action as that of combing his hair with the article offered him New a curious fact is, that, while the brain is, of ec symmetrical as to its gross structure, its two balves in the adult individual are found to be set apart for an essentially different set of functions. In righthanded persons practically all the higher mental faculties are seated in the left carebral hemisphere. This disarmmetry in the development of the bady and brain is accompanied not unnaturally, by a certain inequality in the features of the two halv certain inequality in the features of the two halves of the face We are so accustomed to viewing a face as one unit, that the usually slight differences between the right and left sides do not ordinarily strike us But by a very simple artifice devised by Halberrorden, and described by Dr Hildsbrandt in Uber Lond und Mere this pseculiarity of the human countenance is brought out clearly The method has the further advantage that it enables us to instinctively interpret each of the two aspects of the face by that involuntary faculty of judging fac is partly innate in us and partly sharpened by incosint practice. Hallervorden simply takes an exactly full face portrait of the person who is to form the subject of the experiment, and makes two copi-one prepared in the ordinary way the other inverte-(This latter is easily obtained if the negative is taken on a thin film which is then simply copied with the film side outward) Each copy is divided in two by an exactly median cut (halving the line between the pupils of the eyes), and the right half of the true copy is joined to the left half by the inverted copy (corresponding to the right side of the inverted copy (corresponding to the right side of the original) in this way an entire face is obtained, containing only the features of the person's right side Similary a left-sided face is objectively, or illustrations show a number of portraits treated in this way It may be observed that the right-sided face has a rather more wide-awake expression, in each case than the left-sided face There is something more passive and lifeless about the left-sided face. The gibt-sided face essents to express more truly the intellectual character of the individual.

It should be mentioned that the portraits here reproduced are those of right-handed people. In the case of a left handed person, the relations would probably be reversed.

Nuptial Plumage of Birds

I'T has been generally believed that the brilliant plumage exhibited by the males of many species of birds during the spring, that is, during the mating season, is directly connected with the physiological condition of the birds at this time, and various theories have been formulated to account for the facts

Director Joseph Grinnell, of the Museum of Vertebrate Zoology of the University of California, has found in the California linnet some facts that de not agree with the common belief in this bird the male





Original portrait.









Original portrait.

Might sepest.

THE RIGHT AND THE LEFT PAOR

tures of which one may be minimed which consists of a safety device preventing any possibility of ax posing the same plate twice. Another interesting device is an arrangement whereby the camera ordining infantially arts fisted yin position for focusing (infinitely) distant objects, that is to say in the positiog corresponding to the "fixed focus." To give an idea of the extreme applicability of this new camera it may be stated that if has been successfully used even for such difficult cases as the photograph-

ism juvolved in articulating. He has almajy lest his "word-eesse," and is suffering from whit; this his "word-eesse," and is suffering from whit; this physicals pain "motor aphenais." Injury to another brain beater leaves a man some power of speech, bied, though his hearing is perfect, he can side unifstand a word of what is said to him. This centtion is technically known as "agnexis." Bittl another aberratico, known as "agnexis." Issues a man with his normal fessities of understanding but, while he is not fearabled, he is thingapting of mostli-

presents a very brilliant red breast and sicile desire its matter occors. Whereast on the sections and milesides stathers have a doll grayfest coloring, retts a loss deligiestics of pints. But the bird does not motify for the feathers. In the surtage, sor is fixes one pages dreaded in the feathers. By collecting in series of Sections from August, when this high tops joint, to the bellow those August when this high tops joint, to the bellow that August when the high tops joint, to the bellow that the disaster of the section of the section rad to collect the disaster of the section of the section of two found that to this section desired the section of the rad to collect the section of the section of the section of the page of the section of the section of the section of the section of the rad to collect the section of by the edge of the adjacent feathers. The overlanding sons are white, and very brittle. During the winer these delicate portions are rubbed off and lost, so at when the mating season arrives, the bird has its at cont. Mr. Grinnell emphasizes especially the fact that this brilliant coloring is actually produced in the fall, after the mating season, at a time of the year when the vitality of the birds is supposed to be

Archseapteryx the Primordial Bird

CIENCE has its share of romance. More obvious perhaps than in other departments, is this ele-ment in palsontology, the

science which seeks to re-construct and spread before our mind's eye the con-ditions and forms of life upon earth in ages long past, extending back mil-Hons of years before the ad-went of man. The study of the fossil remains of far-off procenitors of our contempfellow-inhabitants of this globe speaks to the imagination with an irresistible invitation to summon up before our mental vision a vivid view of the strange and often terrible forms which in the gray dawn of our present era peopled this planet. And the picture which thus rises before us is wonderful enough to satisfy the demands of the most

est and wonder in the most matter-of-fact and unimaginative mind.

From a more strictly scientific point of view, the principal interest attached to the study of paleontology arises from its relation to the theory of evolutology arress from its relation to the testy of the tion, and the light which it sheds on many phases of the problem of the origin and development of species. From time to time a new specimen is discovered which reveals some feature of surpassing interest, some drastic example of the universal thread

Fig. 1.-Slab discovered in 1861.

which connects all forms of life.

We celebrate this year the fiftieth anniversary of stance of this kind, and on this occasion C. W. Neumann recalls the circumstances of the case, in Half a an article published in Reclams Universum. century ago Dr. Häberlein, a German physician, discovered at Solenhopen a specimen of a remarkable creature, combining in itself some of the essential characteristics of birds with those of a reptile. Impressed upon a slab of the Solenhofen calcareous slate there appeared, in the find of 1861, an almost complete skeleton, considerably shuffed up, it is true, yet clearly enough defined, and scattered among the bones were seen an abundance of large feathers. One remarkable feature, such as is found in no existing bird, was the long tail, containing a large number of vertebres, and set with a series of long stiff feathers in fern-leaf fashion. A well-preserved foot (clearly visible in Fig. 1 of our illustrations) is colourly visible in Fig. 10 claws. Head and neck were missing on this specimen. It was therefore with great joy that pelsoontologists received the news. some sixteen years later, that a second, and this time a remarkably perfect specimen had been found, in the same locality as the first. A view of

this is shown in Fig. 2 of our illustration. es us to form a very accurate idea It enal the actual character and appearance of pteryx," that is to say, "Prime the "Archespteryx," that is to may, "Primor-dial Bird," as this animal has been termed. The result of the scientific reconstruction of he specimen is visualised in Fig 3 of our the spectmen is visualized in Fig 3 of our limestation. Archespitory, Donespied a pair of whigs, with which it doubly propelled and statedned bealf in miself, after the filmses of a July 3. and were armied with chave, and were evi-dently used by Archeapterys to take hold of dispots, such as the branches of trees, to sailed in supporting himself, and perhaps to clambing. The form of the vertebra, and depositably the foots tall, are quite observed and a vertile, and the month or book in the sailed of a vertile, and the month or book in the sailed tall, but it occurs quite char-celes of a vertile, and the month of the charter of the sailed field, but it occurs quite char-celes of the sailed of the sail of the cases of the sail were armed with claws, and were evithrough a toothed stage. It is a well-known funda-mental law of biology that every individual, in the course of his development, recapitulates in more or less distinct (though, of course, abbreviated) s-quence, the stages through which his species as a whole has passed in its evolution during past gener-

Palseontology and embryology therefore unite in this, as in so many other instances, and by their evidence proclaim the origin of the feathered folk. It appears that the remote ancestors of the birds were winged reptiles. And the Archæapteryx takes its place near the transition line—not quite bird, yet more than reptile, it stands as a connecting link on



Fig. 3.-Ideal reconstruction.

From Res ne Unic Fig. 2. - Slab found in 1877. ARCHAEAPTERYX THE PRIMORDIAL BIRD

that slab of Solenhofen slate, a page in the earth's historical record of ages long gone by.

Measuring Your Intelligence: John Gray's New Instrument for Testing "Perseveration."

No science makes much progress until its votaries succeed in applying to its phenomena the meth-of exact measurement. The sciences of chemistry and physics, after the introduction of exact methods thing and of measuring space, temperature, and potential, advanced by leans and bounds good reason, therefore, to believe that the application

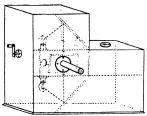


Fig. 1.-Apparatus for measuring perseverati



THE MRASUEIMENT OF PERSEVERATION AND ITS VALUE AS

of measurement would lead to a corresponding great advance in that science, by no means the least important, which deals with the evolution of man himself.

An instance of such an application is described by John Gray in our contemporary Knowledge, from which we quote the paragraphs which follow:

'It will be convenient, in explaining the nature of the exact science of man, or, as it is usually called, anthropometry, to regard man as a machine, comprising a framework or structure and highly complex functions

"To measure the framework of man is a compara tively easy matter. With the graduated rod and the

19.3

calipers we can measure stat ures, head diameters, and other dimensions of the body, and the weight can be measured with the weighing machine

"The simpler physiological functions, such as aculty of vision, color vision, and other sensory characters, can also be readily measured But. when we come to deal with the more complex physiclogical functions, those ally known as psychological. the difficulty greatly

creases "The value of measure ments of psychological ог mental characters is, however, so great that strenuous efforts have recently been made by anthropologists to discover some more or less exact methods Intelligence,

for example, plays so important a part an all the affairs of human life, that a fairly accurate method of measuring it would be of the greatest practical value to the educationist, to the military or naval officer and to the business man not to speak of the impulse which it would give to the science of man

"Most of the methods of measuring intelligence at present in vogue are personal estimates by teachers or others who are acquainted by long experience with the mental character of the person to be tested These methods have been found to be only very rough approximations, as there is by no means good agraement between the results obtained by different ob-

"The examination test is recognized as a good of intelligence, but it involves other factors which have little or nothing to do with intelligence, and its correlation with success in after life is not very high.

"It appears to me that simple and exact methods of measuring certain physiological properties of the brain which have a great influence on our mental growth, promise to give much more valuable results in the measurement of mental character than either the person; i estimate or the examination test

"As an example of this I take the measurement of pensistence of a nervous current or disturbance in the brain after the external impulse has ceased

For this purpose I have devised a simple apparatus by which flashes of colored light can be thrown in

The apparatus consists of a revolving mirror, the axis of which is horizontal, and which can be turned at any required speed by a handle and belt gearing

The speed at which the axis is rotating at any instant is shown by a speed indicator connected to its free end.

"The mirror revolves in a dark box hav ing windows of colored glass directly above and below the mirror Outside each window is a screen of white paper fixed at an angle of 45 deg to the plane of the glass, and illuminated by an electric glow lamp, or by other constant source of light

A beam of diffuse light thus pass through the colored glass of the window and impinges on the mirror As the mirror revolves, the colored reflected beam passes over an aperture in the side of the box, against which the eye of the person being tested is placed. When the reflected beam has passed over the aperture, the color im pulse on the retina ceases until the mirror has reached the position in which it re-flects the next colored beam of light into the

"The experiments of Shelford Bidwell, and of others, have shown that the sensa-tion of a color persists for a short time after the external impulse has ceased. If the duration of this persistence is equal to the time interval between two successive impulses the revolving mirror, the color will app be continuous. But if the persistence is less than the time interval, the color will appear to flicker
"in order to measure the duration of the persist

ence in any given person all that is necessary is to ascertain from the speed indicator on the axis of the mirror, the exact number of revolutions which the axis is making when the flicker disappears. It is best to start very slowly, and gradually increase the number of revolutions of the mirror until the flicker disappears The reading is taken from the speed indicator at this critical speed. The persistence of color sensations in the person being tested is inversely proportional to the critical speed.

"Experiments made by Nichols, Ferry, Abney, Burch, and Allen show that color blindness causes an abnormal increase of the persistence of the primary color or colors to which the subject happens to be

of color blindness. After we have obtained sufficient statistics of the persistence of persons with normal color vision, we may safely recken any abnormal de viation from this average as an indication of color blindness

THE DEFERMINATION OF MENTAL CHARACTER

"This persistence of a color sensation after the stimulus has stopped, which we have been discussing, is identical, or very closely related to a quality of is identical, or very closely related to a quanty of mind which the psychologists call perseveration. The amount of this perseveration is probably a funda-mental property of the germ plasm, and, therefore, inherited from our ancestors

"The growth of the mental character of an indi vidual as he passes from childhood to maturity is greatly influenced by the amount of his perseveration Perseveration influences mental growth by the con trol which it exercises upon the formation of associas between two or more neural systems

"When a nervous impulse passes through a neural track in the brain it reduces the resistance of the track, so that following impulses pass with much greater facility

"This diminution of resistance by the passage of a This diminution of resistance by the passage on a nervous impulse is called the law of neural habit According to James, the law of neural habit is the foundation of all mental growth. From the psycho-logical point of view this is equivalent to saying that all mental growth consists in the formation of asso ciations between different perceptions

'In order to form an association between two per-ceptions the neural systems in the cortex of the brain, which represent these perceptions, must be excited in immediate succession. For example, a child, when looking at a ship, is told its name. The name is ever rwards associated with the appearance of the ship in the mind of the child.

What has taken place in the brain of the child? The neural system, a, representing the visual percepthe ship, was first excited, and imme afterward the neural system, b, representing the auditory perception of the name of the ship, was excited. The effect of the total operation was to form a path of reduced resis ance between a and b, so that wh is next excited a nervous current passes across to b.

and creates an image of the name of the ship.
"According to McDougali's theory, the excitement of b exerts a guiding influence upon the discharge from a determining the discharge to take place from a to b A physical analogy which helps to explain this phenomenon is the passage of an electric spark from a point at high potential to another point at low potential. The point at low potential determines the direction in which the spark will leave the point at high potential. The passage of the spark through the air reduces the resistance of its frack, though this reduction lasts for a comparatively short time compared with the diminution produced the neural track connecting a and b in the cortex of the brain

condition, however, to which I wish to direct special attention is that the difference of potential b is produced only when the wave of excitement through a immediately before the second wave of excitement passes through b. It is necessary also that the excitement of a shall be very much reduced before b is excited

The conclusion forced upon us by the above con siderations is that anything which retards the rate at which the excitement of a neural system dies out, reduces its power of forming associations with other neural systems. But when once an association, i. s., a track of low conductivity is formed, say, by sufficient repetitions, the nervous currents which flow through the track will last longer

"Now, the property of high persistence, or persever ation, which we measure by the apparatus described above, will have the effect of retarding the disappear

ance of the excitement in a neural system.

"We should expect, therefore, that persons with high perseveration would form new associations with great difficulty, and persons with low perseveration would form them with great ease and rapidity.

"Dr. Otto Gross, in his treatise on the Secondary unction, has deduced in a most ingenious way, from this physiological hypothesis, the different kinds of mental character that are likely to arise, from various amounts of the secondary function, or, as we have d it, perseveration

"From the conclusions arrived at by Gross I have drawn up a scale of perseveration, and the kind of character likely to be associated with different degrees eration, in the ordinary conditions of life

"At the center of the scale we have the average of perseveration, which is associated with the practical common sense of the average man.

hen the perseveration is below the average the speed with which ideas flow through the mind quickened, and the readiness with which the mind receives external impressions is also increased.

"The first category below the average, therefore, contains persons with witty, brilliant, and suggestive minds, persons of great tact, presence of mind, and daring; all of which imply quick response to external

To this class would belong the majority of perwho are popularly considered to be geniuses. But if we adopt Carlyle's definition of genius as 'an infinite capacity for taking pains,' the genius would have to be looked for in the class having persevera tion one degree above the average.

"The category with perseveration one degree above the average contains persons who are fond of abstract thinking, and who follow a theme into all its ramifi-cations. They think slowly and learn slowly. The scope of their consciousness is wide, but they are not quick of apprehension because they do not respond readily to outside stimuli

We may say, therefore, that the classes with perseveration one degree below the average and with one degree above the average, produce geniuses of different types, who, while they excel in one direction have also certain defects associated with their excel lent qualities.

When we pass to the classes of persons with perseveration two degrees above or below the average, these defects are intensified, and serious deterioration of mental character begins to appear

The category with perseveration two degrees below the average contains persons who cannot keep their thoughts long on one theme, frivolous persons who are fond of superficial associations, such as punsters and cynics; persons to whom all emotions are of equal value and who are consequently of weak moral charpersons who learn anything new very quickly but superficially.

"On the other hand, the category with perseverati two degrees above the average contains persons with quite opposite defects. The long duration of the secondary function interferes with the formation of wide associations, and renders the limited associations formed exceedingly stable and inaccessible to outside influences This corresponds to the person with fixed ideas, apparently founded on sentiment rather than on reason. Gross somewhat invidiously includes in this category vegetarians and anti-vaccinators, but it is preferable to leave the truth of that assertion to be determined by experiment.

"When perseveration falls below, or rises above that of the two categories last described, the mind becomes unstable-we pass from the sane to the insane

The insanity at the two extreme ends of the scale is of quite different types Persons with excessively low perseveration are liable to acute mania, and persons with excessively high perseveration usually suffer

"The symptoms of these two classes of the insane are deducible by Gross's hypothesis from the influonce of excessively low or excessively high perseveration on the formation and action of the mi

"A considerable number of persons of both seven have been measured with the revolving mirror apperatus, in the Anthropometric Bureau at the Japan

Though the whole of the data obtained have not yet been analyzed, the following are some of the results obtained from the measurement of eightytwo men and twenty-six women. two men and twenty-six women. , comparison of the Perseveration of the two sexes.

COMPARISON OF THE PERSPECTATION OF THE TWO SEXUS.

"The first question I set out to determine was whether there was any significant difference between the appraise perseveration of the two senses.

"I found that this mean perseveration of the vighty-two men was 1250" suits; while the mean of the venty-six women wide 1256 of the same units.

"This amounts to a difference of fitteen units hereafted the same persevent the average publication of the two sexus.

"We arrive, therefore, "Mr., this Supertant conclusion."

that the average perseveration of wor

significantly less than that of men.

"This lower perseveration of women we should expect to be associated with the mental characters indicated on our scale, i. e., we should expect in women greater quickness of apprehension, tact and presence of mind than in men, with a diminution of those good qualities which are associated with high perseveration. This, I think, agrees pretty well with general experience.

COMPARISON OF PERSEVERATION OF LIGHT AND DARK

HAIRED PERSONS "The next point I endeavored to determine was whether there was any real difference between the perseveration of light and of dark-haired persons.

"Hair color being a very valuable criterion of race in northern Europe, we might expect to decide from the results obtained the difference between the characters of the fair Anglo-Saxon element and the dark Mediterranean element, in the population of the British Isles.

"The hair colors were classified in two categories, namely, light, including fair and light brown; and dark, including dark brown and black.

"I find from my figures that the average persever

what higher perseveration than the dark Iberian, or Mediterranean, race, and the mental characters associated with the various degrees of perseveration that are to be expected in these races."

Inheritance of Size and Shape

his experiments on inheritance, Prof W. Castle of Harvard found that when rabbits having ears of different lengths were crossed, the offspring had cars of intermediate length. Similar results as to the "blending" of a character had been obtained in the case of Indian corn, where varieties that have different characteristic heights would produce hybrid offspring of intermediate heights. From these facts the general ization had been drawn that in matters of size inheritance was likely to be "blended." Exceptions to this law were known. most conspicuous is the case of the sweet pea, with which Mendel himself had experi mented. In this group of plants it was found that when a dwarf variety was crossed with a tall variety, all the hybrid individuals were tall; but in the follow ing generation the two characters were seggregated out in the typical Mendelian fashion. Castle explained the difference between the behavior of the sweet peas and that of the maize or the rabbits' ears by assuming that the "dwarf" sweet pea was a form possessing a distinct, discontinuous character, whereas in the ca of the Indian corn the varieties are simply fluctuating variations, so far at least as the size is concerned.

R. A. Emerson, Professor of Horticulture at the University of Nebraska, has carried on some experi-ments on this problem and concludes that in the matter of size, as in certain other characters, the inheritance is truly Mendelian He used size of grain and taliness of stalk in Indian corn, size and shape of summer squashes, size and shape of gourds, and size shape, and weight of various kinds of beans as characters for his test. In all cases he found that the first hybrid generation always gave quantitative results in termediate between the two parental characters. But on breeding from the new plants for another year he obtained results that point to a real seggregation although the facts of size and shape are more complex than the facts of color inheritance. In this third gen eration he obtained individuals that were as large as the larger of the two grand-parents; some that were as small as the smaller grand-parent; some that were of the same size as the hybrid parent; and some int diate between the hybrid and the two extremes. It would be necessary to breed for at least one more generation before the separation of characters can be completed; and it is planned to continue the experiment this year (1911).

Contrary to widespread belief, the first hybrid generation did not show any greater range of variation than either of the parent forms; hybridisation does not create new characters. It was also found that the ratio between length and breadth in the different se fruits, etc., studied were not materially influenced by rruis, sec, stunies were not materially influenced by the crosses, so that the shapes of the hybrid organs were the same as those of the parents, so far as, the conditions would allow. One of the special difficulties involved in carrying on experiments of this natural is the fact that the outward conditions of temperatu tillumination, moisture, etc., so result modify the measurements, that in some cases it would be impossible to tell whether a little earn tailings or whight size violance of an inherited characters, for the result of lawweble autilities.

Curiosities of Science and Invention

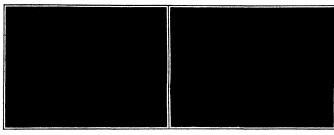
the well-dressed dandy twirling a light cane, for at a moment's notice he may wrench off the handle of his walking stick and blase away at you with a six-bar-roled revolver. Should this fall to down the enemy,

he may use the dagger projecting from the barrel of

Novel Contrivance for Bowling Alleys

To do away with the necessity of setting up the pins in a bowling alley after they have bowled over, an ingenious inventor has contrived an automatic device.

The pins are hinged to a frame hat extends over them, and when they are struck by the balls, they are swung up ward instead of being knocked down, and are held this position by means of a spring catch on each pin. The bowler may reset the pine by pulling a lever, which releases the catches and drop to normal



Bowling alley with felt-covered floor and device for setting the pins automatically.

While this arrangement of setting the pins has the advantage of placing the pins always in correct position, so that the bowler need not blame the attendant if he fails to make a strike, it also possesses the disadvantage, particularly to the novice, that the pins do not knock each other down helter skelter, as in the usual game. Hence the game must be more scientific. The inventor has also provided a felt floor for the bowling alley, so that the balls in rolling down the alley will make no noise.

A Human Diabolo

THE man who tries to invent a "thriller" that will surpass previous daring circus performances has a difficult task in these days, owing to the fact that almost every concelvable method of tossing the human body about in loop-the-loops, in somersaulting automobiles, out of cannon, etc, has already been done. In thus making a plaything of human life, it is natural for him to turn to children's games for suggestions. Recently an inventor has conceived of using the idea employed in the game "diabolo." A large spool or diabolo is made to roll down a steep large spool or diagono is made to roll down a steep inclined plane, and thence is shot up into the air, landing finally on a net. Within this diabolo, with her head and shoulders projecting, is a young Parisienne, Mms. R Furle, who undergoes the performance without any serious consequences, despite the fact that the centrifugal force developed by the rapidly revolving diabolo must produce a tremend-

ous strain on the muscles, to say nothing of the dizziness caused by the rapid whirling

Weapons in Walking Sticks

THOSE who look with contempt upon a cane as a useless orna-ment and a harmless weapon evolved from the old-time bludgeon, evidently do not know much about the condition of af-fairs in France, where the inoffensive-looking walking stick may con-ceal the most dangerous weapon. In France, the carrying of arms is pro-hibited. On the other hand, the respectable sen is frequently obliged to protect himself against the "Apachos," For this reason, considerable in-genuity has been exer-cised in concealing within the otherwise innocentearing walking stick a ent means of de fense. To such an extent has this art been carried, that one need no longer hell with obstempt upon



The human diabolo rolls down the steep incline and is sed into the air.



The handle is a six-shooter and dagger.

The cane makes a first-class rifle ...



A twist of the stick projects a beyonet from the handle The case may centain a sword or a blackingle.

WEAPONS CONCEALED IN PRENCH WALKING STICES

the revolver for short-range fighting. One of the accompanying illustrations shows a rifle that has been concealed in a walking stick. The rifle is provided with a shoulder rest, which may quickly be unfolded and applied. Another illustration shows a sword

that has been cane, while still another illus trates a cane so constructed that a simple move nent of the stick will bring out a bayonet from the upper end There one form of weapon that might be of serman, but we are inclined to think that it would be of more value to a footpad The stick contains an ugly black jack consisting of

a rubber whip loaded with a heavy metal end

Electric Traction

A MONG the most recent projects in the way of A electric traction on standard gage railroads, we note the plans which the South Railroad of France is making upon the Bayonne-Toulouse ratiroad in the is making upon the Hayonne-Toulouse ratirond in the Pyrenees region Owing to the difficulty of operating by steam, a part of the line will use electric trains with specially designed locomotives for the heavy gradients A single-phase 1,200-horse-power locom tive weighing 90 tons will be used, also a type of motor car with four 125-horse-power motors. Two hydraulic plants and perhaps a third will be erected bydraulle plants and perhaps a third will be erected for the current supply, working the power lines on the three-phase 55,000-volt system. The first plant at Eget will use a high fall of 2,000 feet, and a second plant will be located at Pierreflite. About \$1,000,000 will be needed for the plants, not counting the machines. Substations will deliver the current to a trolley wire which takes 12,000 volts. Transformers will be placed on the locomotives for lowering the voltage for the motors. On one of the leading rational times of Switzerland, the Rhistiache Babb, there lines of Switzerland, the Rhatische Bahn, there are to be three sections laid out for electric traction, the Bevers-St. Moritz and two others Current will be supplied from the great Brusio hydraulic plant lying near the Italian frontier Among the local lines which are to be specially built for electric traction we note the light railroad running from Rome to Anticoli and Frascati It

will be about 80 miles long Milan is the starting point of a 25-mile electric trac-tion line running to Ombriano and other towns In the Italian lake region a tourist electric road will be built between Intra and Premeno, so as to give access to the moun-tains adjoining the lakes In order to cross the mountains by the St Bermountains by the St Her-nard route and connect the rathroad station of Martigny and Orsières, there is building a standard-gage line which will rank among the promi nent railroads of this class in Switzerland Owing to the nature of the region which it verses, following as it does the beautiful valley of the Drause River, this road oralis for much engineer-ing skill and ingenuity and will require a con-siderable amount of construction work in the way of bridges and tunnel: All of which will add greatly to the charm of travel through this picturcaque region.

The Schilowsky Low-speed Gyroscope Monorail

A Method of Maintaining Equilibrium With a Comparatively Slow Gyroscope

By the English Correspondent of the Scientific American

DURING the past few months, engineering interest in England has been occupied by a new gyroscope monorall system, which possesses many interesting and novel features It is the invantion of his Excellency, Monsieur Plarre Behliowsky, the governor of Kostroma, Russia, who personally carried out the initial demon-

sonairy carried out in the man model strations in London with the small model which he had constructed Through the courtesy of his Excellency and his consulting engineer, Mr. George Eckford Kensington, we are enabled to describe the outstanding features of this system.

the outstanding features of this system. The inventor, although adopting the gyroscope as a means of maintaining equilibrium on a single line, has elaborated a new means of utilizing this principle. There is a special regulating mechanism, by means of which any deviation from the prome personal results. viation from the proper horizontal tion of the gyroscope, and the vehicle upon which it is mounted, is immedi-ately and automatically effected. The outcome of this arrangement is that a high velocity on the part of the gyroscope, with its attendant difficulties and dangers in regard to mounting, is not necessary A low gyro-speed dispenses with the necessity of securing a very

accurate balancing, fine workmanship, and working in racco, as in the case of the high-speed system, with the result that greater simplicity and more facile conof the machinery is secured

This inventor advocates the mounting of the gyroscope and its attendant mechanism upon an inde-pendent vehicle or gyro-car, but this is not essential. In the model experiments he adopted the arrangement shown in the accompanying illustrations, the monotrain being built up illustrations, the monotrain being outh are as follows: Locomotive, gyro-car, two coaches, gyro-car, two coaches, and so on throughout the length of the train; but many other modifications are practicable Steam or electricity may be used as the motive power for the train, gyroscope, and regulating mechanism, according to which type of prime mover is the more con-

ventent

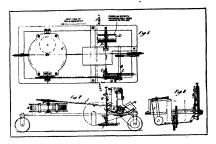
The principle of the system may be gathered from the accompanying diagrams. The gyroscope A mounted on its car is driven by an independent engine or motor. The shaft B and pinion C are driven constantly by a second independent engine at a low speed. When the pendulum D a low speed. When the pendulum D swings to the right, owing to the oscillation of the car, it pulls the crank E through the chain F, thereby drawing down the rod G, which pulls up the internally-toothed quadrant H. This action causes teeth. J to enages momentarily with the pinion C, so that the quadrant thus gets a "kick" forward. This "kick" is conveyed through J to the gyro frame in the direction of the deviation of the system on the second through the control of t tion of the deviation of the gyroscope. The latter immediately "kicks" back toward the horizontal position, and continues its oscillation backward, but through a smaller arc. When the gyroscope again oscillates forward, the regulating mechanism again in tervenes, but less forcibly, until, after a few diminishing oscillations, the gyroscope re-mains perfectly horizontal It must be pointed out that these "oscillations" are very small, the correction being extremely sensitive. It must also be observed that the shaft B and the pinion C are always rotat-ing It is quite immaterial whether the first

disturbing oscillation of the car be to the left, which vould not actuate the regulating mechan-Jam; for the next oscillation would be to the right, and the pendulum would pick-this up imme-

tion of a full-sized train and track built upon this principle in his home country, the experiments with the models having proved so successful that the Russian government engineers have expressed a desire to see the system in actual operation under normal conditions, with a view to its adoption as an inex-pensive means of transportation in the sparsely populated districts of the empire.

Improved Letter Boxes

I f the committee which the Postmaster-General appointed some time ago to determine upon a style of new street letter box which may come to



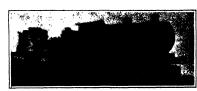
Plan and elevations of the gyroscope and balancing me

the requirements of the service makes a favorable report, one may see at no late date a new and novel device for the reception of letter mail.

As yet the exact style and design have not been

decided upon, but it is safe to assume that the new box will add beauty to any street corner.

There are several factors entering into the pro-



Gyroscope and mechanism carried on an independent car coupled to



The gyro-car, showing the balancing mechanism which enables the a of a slow-speed gy

posed change in letter boxes, and they are not minor ones either. Heretofore the letter boxes have been unhandy to the collectors, and it has entailed more time to unlock and close them than has seemed necessary. What the Post Office Department has in min is the introduction of a letter box which may

is the introduction of a letter box which may be empited with one motion.

Time also essess fints the case, and it is demonstrated that many hours can be saved each day, more trips may be made by the collectors, and better service in the handling of mail can be had with a depice box which will permit all the mail to be taken out of con newsmost. With a light copie, and the contraction of th

box may be emptied in two or three as means a saving of at least twenty seconds, at each box, and in the end means a saving of searly seven hundreds hours very time a collection is made throughout the United States. Looking at it from the

standpoint of economy, and con that in most of the larger cities there are often ten and more collections a day,

shows a big waste in postal funds. shows a big waste in postal runos...

It is proposed also to have a time indicator and an indestructible card attached to the box, which will show the time at which the next collection is to be made. Several devices have already been experimented with by the Departm but the results have not convinced the officials of the adaptability of the boxes. One device experimented with consisted One device experimented with consisted of a set of cards, set into an endless chain, each bearing a different title. When the box was opened, a new card was automatically advanced before the opening in the front of the box, on which was printed the time of the next col-

There is one point made in favor of the automatic register boxes, and that is that it places a check on the collector, and prevents him from skipping a box by If the next collection is not made at proper time, the indicator will show the fact to any one who examines the box.

For several years past the rost Office Department has considered new styles in letter boxes, and many of them have been given trials in some large city, where their operation might be closely watched. None of these, however, has met the demands of

the Department.

The Department has extended an invita-tion to those having ideas on the subject to submit plans and drawings of improved letter boxes to the First Assistant Postmastereral, under whose jurisdiction the mat ter comes

ose who contemplate entering plans should bear in mind that several things should be taken into consideration, and that they are important factors that enter largely into the success of their venture. Economy of time for the collector, artistic appearance of the box, an indestructible time card, and an automatic indicator. To be sure, the time card becomes unnecessary if the automatic indicator works satis-factorily, but it must be considered as part

Five Times in Four Hundred Years

WITH the beginning of the second dec ade of the twentieth century (1911) some very strange and interesting facts are

That the beginning of 1911 being on Sunday, the first day of the week, the first day of the month, and the first day of the year, is not so strange as that the first day of the lecades are very few that start out on Sun-This singular coincidence in the ades has occurred before only five time in just four hundred years, when in 1541. in just four numered years, when in 1811, according to the Gregorian calendar (new style), it was the same as now, 1911. Again it occurred in 1861, then again in 1861, and again in 1861, and then the last

1651, and again in 1741, and then the last
before now was the beginning of the discade
1871, forty years ago. The next time that
it will come will be 1981, or fifty years
hence, and the next time after that will be
3081; then again in 1241, the next in 1871, and
then again in 2311, or four hundred years then
now, and so along down through the lages agnow, and so along down through the lages agtion with periodic of four hundred years from each of the years
given above, it is also very interesting to into that
alone 'the hencifolists' of the Christian, and according
to the 'effica and Style Christian, and 'eight and 'eight christian, and 'eight and 'eight christian, and 'eight and ' and fosterent on Style Calefolia, that the and fosterents on contarion, that is, for and it who cale outsides in the first of the state of the state



The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting



Report Mufflers for Firearms

An Interesting Field of Invention

ONE of the most characteristic features of our era is the dominion which man has gained over the brute s of nature. The steam engine has multiplied the strength of his arm a thousand-fold. The dweller in the modern metropolis scarcely passes an hour of his working day without borrowing power from nature's store, or tapping one or another thread in that network of nerves which has grown through and through our civilised communities, establishing connections everywhere, and uniting into one sentient body the entire nation, For the modern man has not one pair alone of eyes or ears, narrowly limited to the po ception of events taking place in his immediate neighborhood. Through a multitude of windows his mind looks out over a horizon stretching from ocean to ocean. and from the gazing eye, the listening ear, the news is presently flashed along the wires of telephones and telegraph, or, ather to a thousand conscious minds, the in our illustration. For some of these soul of the community.

This have science and the ingenuity of man done for the arts of pe

But our present era is a child born of er. Some of the earliest applications of nature's inorganic forces to man's use ere made in weapons of defense and attack. If modern man has harnessed the unruly force of explosive disruption in motors to assist his peaceful pursuits, we call to mind that he first made use of this agent many years before the rise of modern industrialism, for purposes of The archer of yore stretched his bow by the strength of his arm, and nothing but that strength was imparted to the arrow presently sped from the bow. With the advent of fire-arms an almost unlimited power was placed in the hands of each combatant, a power altogether out of proportion with his own inherent

this advantage gained. The arrow flies central channel The portion of the gases in section almost poiselessly from the archer's hand The blunderbuss proclaimed by a loud report-the origin of the missile, and eneloped the sender in a cloud of smoke which confirmed and amplified the evidence of the report, and at the same time for a space dimmed his vision. It is true that the modern gun, fired with "smokeless" powder, in a measure avoids these defects. The report from a large cannon however is not only audible at great distances, but may, owing to its extreme vio- The endeavor is to impede the exit of the expand, they acquire, by the action of lence, cause positive injury to those stationed in close proximity. The recoil of fire-arms also is an undesirable effect, if only in view of its unfavorable influence upon the accuracy of aim. The escape of gases in irregular eddies from the muzzle device shown in the first cut of Fig 1 with greatly reduced velocity of the gun has a similar effect.

inventors have accordingly for many years past endeavored to overcome some ese disadvantages. The result of such efforts has been the production of a that the gases can escape only through to provide lateral exit channels for the number of gun "silencers" since but yesterday, through the unaided of which some typical examples are shown The device depicted in Fig. 2 consists of ficient distance along the barrel of the it is claimed also that they reduce the "recoil" of the fire-arm. To what extent These disks are each split by a radial cut, this latter effect is realizable appears and joined together in helical arrange somewhat doubtful, for the recoil is at least in a large measure due to the reaction of the missile, and this can not possibly be avoided. Only that portion of

> cannon, and made in the form of a pertitioned casing, of annular cross section

energies. Yet not without sacrifice was radial partitions, and opening into the view in Fig. 10 shows on so diverted impinges against the front strengthen the sphere and prevent its wall of the casing, thus producing as it collapse under the force of the blast were a "forward" recoil, if we may be has come into use, nor does it appear to jectile extends

possess the qualities which would make for success.

obtain this effect vary considerably. The chamber to chamber and consists of a valve which is depressed by the sudden onrush of gases after the bul se causes the partial closure of the bore, so and containing a series of baffle disks. sage of the bullet

These may be said to differ merely in shown in Fig. 4. It consists of an attach especially designed to impart a whirling some inclined, so as to produce a diffus "hollow ball" muffler contains a number port of spheres which engulf the issuing gases Through the central channel the shot Each sphere is held in place by shoulders Fig 5 works on the theory that the reso out, while the gases rushing after in the side of the casing, and is of course the same are in a large measure diverted provided with a hole in alinement with of air into the barrel, when the vacuum

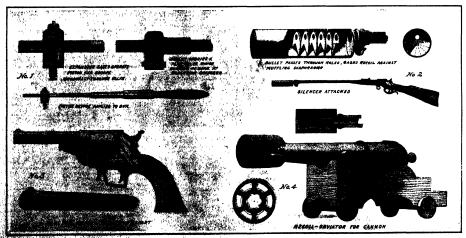
The median rib serves to

The deflector shown in the lower draw permitted to use this phrase, and in part ing of Fig 9 is divided into a number of neutralizing the regular (backward) re- (ells or chambers through which a me coil. We are not aware that this device dian channel for the passage of the pro-

In each cell are disposed a series of stationary vanes or blades, arranged as rep-The basic principle of practically all resented in section on the right. As the the other types of sliencers is the same gases leave the muzzle of the gun and explosion gases from the muzzle, so as the blades, a rauld whirling motion which to convert their ordinarily sudden motion causes them to hug the wall of the chaminto a more or less gradual progress. The ber, and arrests their progress. In this actual means employed in the effort to way they pass somewhat gradually from finally

A rather different type of device is preented by the slotted barrel shown in Fig. let has escaped. The motion of the valve 3, and the perforated muzzle seen in Fig. In these forms of muffler the plan is narrow ports provided for this purpose gases, after the bullet has passed a suf a casing affixed in front of the gua-barrel, gun. The effect aimed at is two-fold. In the first place, by allowing the gases to escape through a number of comparative ly small openings in series, a somewhat A number of holes in alinement gradual release is secured. And secondly, with the bore of the barrel allow the past since these gases issue laterally and be fore reaching the muzzle, the disturbing Similar in principle to this device are effect upon the bullet of the necessarily the recoil may be reduced which is due the Maxim deflector, shown in the upper irregular blast from the muzzle is at to the backward force exerted by the portion of Fig 9, and the same inventor's least in part avoided. The inventor of gases escaping from the muzzle after the silencers represented Figs 8 and 10 the form silencer shown in Fig 7 has sought to increase the latter effect by A device which is designed primarily the particular shape of the baffles em arranging the ports in the sides of the for this purpose of reducing the recoil is played. The baffic disks of Fig 9 are barrels at various angles, some radially, ment to be secured to the mouth of a or eddying motion to the gases. The blast and break up the stream from each

The inventor of the silencer shown in port of a gun is due to the sudden inrush outward into the chambers formed by the the path of the builet. The lower detail first formed by the discharge gives way



TO THE STATE OF TH

under the pressure of the atmosphere He tions may be used gratuitously by the in the manner established in the herein-accordingly provides a valve at the mouth government. In order to encourage in after following articles. of the cannon, which is opened by the rush outward of the explosion gases, but is automatically closed by the subsequent mrush of air The valve has a central aperture of moderate size, covered by a flap which opens inward. In this way the inventor aims to admit air somewhat gradually, so as to prevent or reduce the report. This device seems to have a number of weak points, which will be obvious to the reader

A muffler also working by means of a valve, though on a rather different principle, is that shown in Fig. 6. Here the outgoing blast closes a valve immediately after the passage of the bullet, thus imprisoning the explosion gases

ventors, a new act has been proposed, as follows:

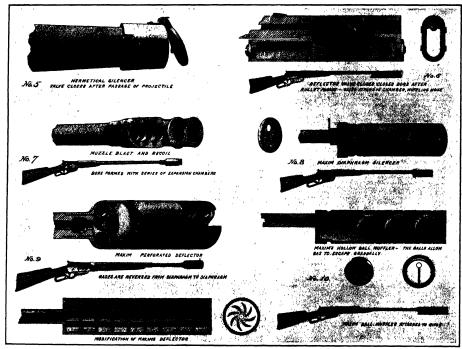
- 1. Compulsory expropriation of patents for inventions and improvements use by the government or for general use is admitted owing to circumstances of state or social necessity-but not other patent, a voluntary agreement concerning wise than for a remuneration according to a fair valuation
- 2 Compulsory expropriation of pat-ents (art 1) may be full or partial, i e, referring only to a part of the rights in connection with a patent.
- 3 Compulsory expropriation of pat ents is allowed in each separate case by an edict of his Majesty A draft of this edict is presented for his Majesty's opin-The problem of constructing an efficient in Chief of a separate section through the compulsory expropriation—if this degun muffler can hardly be said to be satis. Second Department of the State Council partment has no permanent representa-

 If in the course of three months from the day of presentation by the prop-or department, in virtue of his Majesty's edict (art. 3) or decision of the Council of Ministers (art. 5), of a demand in regard to the compulsory expropriation of a a remuneration for the patent which it is intended to expropriate will not come to conclusion, then, for determining the amount of this remuneration, a special committee is formed under the presidency of the Minister of Trade and Industry, the staff of which includes one of the remuneration may be dependent on member each from the Ministry of the remuneration may be dependent on member each from the Ministry of the remuneration may be dependent on the finance and Trade and Industry, the the invention or improvement or the ex-States Control, and the department which tent of the consumption. lon by the proper Minister or Director has raised the question concerning the in Chief of a separate section through the compulsory expropriation—if this de-

information from the In de remuneration for the patent which it is intended to expropriate, the technical qualities of the invention or improvement and those advantages are taken into con aideration which the owner of the m had reason to expect from his invention or improvement.

The remuneration for the comput-11. sory expropriation of a patent may be determined by the committee in the form of a single payment of the whole amount or on the condition of paying a part of this sum immediately, while the balance

12. The decision of the committee about determining the remuneration is considered final if the owner of the pat



DEVICES FOR SILENCING FIREARMS

familiarity with all that has been done up to the present date. And from this standpoint it is hoped that our brief review, gathered from a number of patecifications, may be found serviceable to inventors

A Proposed New Russian Patent Law

I NDER the existing Russian laws, pat-UNDER the existing Russian laws, patcents are not granted for inventions
pulsary expropriation of a patent (art. 3),
of importance relating to munitions of in the case of this request not being
war and to defense of the state, which
granted, the compulsory license of the
ann be died only by the government For patent is immediately stopped and it
inventions and improvements relating to
owner is notified of this fact.

6 The remneration for the compulsor
articles used in the army, which can also
6 The remneration for the compulsor
be employed by private persons, patents
sory expropriation of a patent is deterare granted on condition that the invenmined either by voluntary agreement or
to the day when the estituings or use committees are to commence, the parameter
to to the day when the estituings or use committees are to commence, the parameter
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to the day when the estituings or use committees are to commence, the parameter
to the day when the estituings or use committees are to commence, the parameter
to the day when the estituings or use commence, the
parameter (art. 3).

Statute of industry of 1906)

the requirements of the defense of the state and public safety, compulsory it-cense of a patent may be allowed tem-porarily by decision of the Council of Ministers, on condition, however, that in the course of two months after such a decision the proper Minister or Director in Chief of a separate section should

factorily solved. We leave it to the reader to pick out some of the shortromings of certain of the de-tees shown in the shortromings of certain of the de-tees shown in the respect to the protection by the included of the committee within a before it is granted, but only on receipt the proper Ministers and Directors in month's term from the day he has been toward making advances in any art is a vector or his successor (art 1987 of the organic to the committee). question in regard to the compulsory ex-propriation has been raised by the Min-ister of Trade and Industry, a special 5 In extraordinary cases, urged by person is appointed to act as president of the valuation committee by Imperial

order.

8 The owners of the patents which it is intended to expropriate are granted the right of presenting written as well as oral explanation to the committee, per sonally or through attorneys. In regard

should be presented by the owner of a patent within the term mentioned above through the Minister of Trade and Industry into the second department of the State Council. On examination of such cases by the department they are directed for confirmation by his Majesty in the way established for this.

18. The expenses the

18. The expenses incurred for determining the amount of the remuneration are charged to the credits from which the remuneration for the patents to be expropriated is to be paid

In order to obtain legal force, this act must be sanctioned by the Char, after having been voted upon by the Donnia and he the Council of Sinas. No desire the wording of the law will be subject by To be seen to the second secon

Patent Oddities.

A Decimal Clock.—It is quite incon-mient, when figuring the time of workmen, to have the time expressed in hours and minutes, which is a duodecimal system, while the labor is paid for in dollars and cents, on the decimal system. This difficulty has been very simply over by an inventor in Louisville, Ky.,



A Decimal Clock dial.

who has fitted a clock with a face show ing the ordinary twelve hour numbers and outside of this ten divisions senting the decimal system. The time of this clock is read not in hours and minutes, but in hours and tenths of hours. For instance, a workman starting a job For instance, a workman starting a job at 9:30 would be recorded as started at 9.5. If he completed the job at 12.3, the difference in time, namely, 2.8 hours, is evidently far more simple to calculate than it would be were it expressed in minutes.

Device for Taking Up Slack in Tiller . - The tiller ropes of small craft. such as motor boats, launches, and the like, are quite apt to stretch with use so that the steering wheel has consider able back-lash. This makes it necessary every now and then to overhaul the steering gear and take up the slack in the ropes. To overcome this difficulty the ropes. To overcome this difficulty and permit of taking up the slack with-out any trouble whatever, a double winding drum or hub has been provided for



Device for Taking Up Slack in Tiller Ropes

the steering wheel, the two parts which are provided with intermeshing teeth. Normally, these teeth are kept in mesh by means of the nut that retains ering wheel on its stud. When it is desired to take up slack in the ropes this nut is loosened, the two drum sec tions are moved apart, and one is turned with respect to the other until the tiller ropes are drawn taut, then the two sections are moved into engagement again and made fast by means of the nut.

Bedy-supported Mirror Bracket.-The accompanying drawing illustrates a cently patented device, which should be of particular interest to those who do their own shaving. It consists in a bracket for a shaving mirror, which is so formed that it can be hooked over one's shoulders, bringing the mirror in



Brief Notes on Inventions

Curious Anticipations, --- Many peculiar anticipations have been cited against par ent applications. At one time a Congress man took to the Patent Office a lock in vented by one of his rural constituents The lock was an exact copy of a lock figured in "Price on Locks," showing the lock used on a gate of ancient Thebes thousands of years before Christ Congressman, after examining the illus the officials, exclaimed that he didn't care who that fellow from Thebes was, he cer tainly stole it from his constituent. On another occasion an application for a patent was filed for a flower basket whose construction corresponded in detail with the scriptural description of the ark in which Moses was placed in the bulrushes which, we are told in the second chapter of Exodus, was an ark of bulrushes daubed with slime and with pitch. This is also probably the first recorded in stance of a reinforced concrete structure

The Chinese "Yankee."—The Chinese are said to have invented spectacles as well as to have been the originators of the chief of all arts, printing, the mariner's compass, peculiar stoves, chain hridges, silver forks, India ink, chain pumps, winnowing machines and, sad to say, it is charged that instead of wooden hams originating in Connecticut, they are also monuments of Chinese ingenuity, and one writer long ago said, referring to the wooden products, "they are so adroitly constructed that numer ous buyers are constantly deceived, and frequently it is not until one is boiled and ready to be eaten that it is discovered to be nothing but a large piece of wood under a hogs-skin"

A Valuable Patent. -It is rumored that in a recent consolidation of large electrical firms, the schedule of assets of an absorbed company included one patent which was valued in the transaction at

Legal Notes

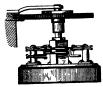
The Voluminous Expert. - The abuses of expert testimony are experienced in nearly all forms of litigation, but nowhere more than in that comprising In patent suits frequently the fees of expert witnesses constitutes large portion of the expense, especially when, as sometimes occurs, one side seeks to corner all the expert witnesses, who are especially skilled in the particular art involved in the patents in suit A well-known Pittsburg patent lawyer in conversation with the writer, in commenting on patent litigation, remarked that very few people could afford its cost We recall hearing an attorney for one of the largest corporations of the United States, in charging delay on his opposing counsel, assert that the latter, and it was not denied, cross-examined his expert witness for twenty-eight days asked one question on his direct examination. Possibly if he had been as two direct questions, the cross-examine tion would still be going on. some one devise means of dispensing with expert witnesses in patent litiga-tion and thus reduce the cost in a very material degree?

The Government and Its Inventor Em ployees.—The law approved on June 25th, 1910, and vesting in the Court of Claims jurisdiction of suits to recover reasonable compensation to the owner of a patent for the unauthorized use of the extented invention by the United States, contains the provision, thought by some to be unreasonable, "That the benefits of this Act shall not inure to any patentee, who, when he makes such claim is in the employment or service of the a convenient position for shaving. Thus Government of the United States; or equipped, one can stand in the most the seatine of any such patentee; nor ferreachie position near a window or shall this Act supply to any device dislicts. The device may be folded into a covered or invented by such employee dest parcels; that it steps he pasked in during the time of his employment or

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Adver-tising Department of the SCIENTIFIC AMERICAN

ELECTRIC SWITCH P 1 McNat funing, lows The invention relates to a switches for electric circuits, and is so signed as to bring one or more branch circ successively into and out of use by continu



SNAP-SWITCH FOR ELECTRIC CIRCUITS.

ionation of the switch, or to cut off the di-cutis cultrely. The apparatus uses high and low contacts arranged to is engaged by sele-or arms disposed on the switch spindle. These arms engage various contacts which are con-nected with the branch circuits to be con-trolled.

troibed MILECTRIC HONTERS - J. KNANNICHTAIN, Clouds Germany. In making circles, silicity is a supersystem of the state of the facility is considered in troibeting the same sufficient is encountered in troibeting the same sufficient is encountered in troibeting the same sufficient is considered in troibeting the same sufficient is considered in transfer in the same sufficient is considered in transfer in the same sufficient is considered in transfer in the same sufficient in the same sufficient is a substitute for a transit and will be combined electric lighters and the explosive charge to be used under water at a consideration of the printing or the present of the printing or the present of the printing or th

Heating and Lighting.

Fleating and Lighting.

VAIVOR CONDENSIBLE—G M Illinois.

Chicago, III. Among the principal objects of this of the mounting of the speciality of the speciality of the speciality is simplified, to provide a structure wherein the joints and possible letkage are minimized, to provide a structure where the possibility of carrying over liquids by the incushing gones, to provide means for trapping and eliminating foreign gases and atmospheric air from the opportunity.

Household Utilities.

Household Utilities,
BRACKET POIR STAIR ROUS AND THE
LINE—J KROME, Now York, N Y The
object in this case is to provide a brucket
arranged to permit convenient opening of the
bracket for the insertion or innoval of the
tool, or clusting and looking of the bracket tor
provent accidental detachment of the rod or
losing any of the parts during the manipula
tion afformed to

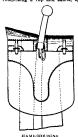
tion a ferred to.

AM 1041.DBR 0 F Ph.Davos, Kewith,
lowa The object here is to provide a holder
for conveniently and removally holding preserving into and the IBs. To accomplish this,
use Is made of a frame howing diametrically
actending arms bound together at their contuit crossing and tenniating in Insteaser for
southing the holder, the space between the
aims is lung adapted to review pressering fars. aums being adapted to receive presseving fars WINDHW SCHEEN - II HARMLE SPOKEN, Wash This inventor has provided a form of golds strips to be affixed to a window, where upon position as district, devices are pre-vised to hold the serior assainst too free a movement on the guide strips. Means are provided also to permit the sever in the sweing outward and to be conveniently and offsethets factored when the just.

Of General Interest,
MAGCAINE 19-14-11 [101-16]; — E. E.
THRASTI, South Comberland Md. The Incention relates to photograph and the object
last operated a holder, arranged to comble the
meet to arisy and use a force number of
platter points in the companies of the companies of the comment of the comment

to the control of the

HAMD-HOUSING T E BLAIR, Portland Origon The invention illustrated herewill provides a housing for the hartes of farmes collars, comprising a cap and skirts, opening



being provided to permit the hames of a collar to extend through the housing. The device has adapted for us upon draft animals, and can be applied or removed very quitely without requiring an adteration in the harvess, in order to make it. It property and without necessitating the veryine of special skill of

COMBINED COMPASS AND TAPE LINE



COMBINED COMPANS AND TAPE LINE.

mining claims and for tracing lines in general. It consists of a casing with a compass at the top and a tage line arranged below or around the compass, the ensing being further provided with sights in diametrical sitigment the results, to direct the lineman in the proper concer.

Machines and Mechanical Devices

Machines and Mechanical Devices, GREASE CIP FILLER, ed, R. La RE, Tell Cily, Ind. The Improvement is for use for illing the cups on machines, with lubri-cant in a seni solid or liquid form. It is more particularly an improvement in so-called "grava-gunv" in which the screen that oper-ates the slidelic piston in provided with a device adapted to engage the throns of the server and time serve temporative as a nut.

device adapted to engage the thronos of the screw and thou service temperative as a nut. (In the control of the control of the control of the part of the control of the control of the part through the control of the ruler, and the styles is faceed analost the paper through particle of the control of the ruler, and the styles is faceed analost the paper through perhaps the control of the control of the versued, and the critical particle of the con-trol of the control of the control of the temperature of the control of the con-trol of the control of the control of the temperature of the control of the con-trol of the con-one con-one con-trol of the con-one con-o

a prior application filed by Mr. Clark
JHR. CRUNK-FF. Southon, Vienna, Austria,
The invention refers to Jib crames and has for
its object to provide a crame in which und
only the Jib, but also the post, may be readily
turned down into the harbonial position and
turned up again so that the higher of the
cuttle crame when not in use is reduced to a
minimum, which is of great importance in
minimum cases.

Prime Movers and Their Accessories.

Prime Rovers and Their Accessories.
CABIDIRETH.—J. N. Privas, and W. P.
EPETT. New Orders, La. This invention has
reference to calminiters for use in connection
with gassiene cagline. One aim of the invertion is to provide a cubicide having a
cup-shaped mixture valve, having a double dat
and whereby the air and gassiene are what
off atmutaneously distributed valve for modelatt whereby J. A. Canatte, Georgeton, Ry.
This improved mulder is for use in connection
with stoom engines, internal combustion engines
and the like, and arranged to effectively mulle-

the exhaust without producing back pressure in the engine cylinder, and to prevent injury to or destruction of the muffler in case of ex-plosion in the muffler.

photon in the number.

TWO CYCIGS INTERNAL COMBUSTION

EXGINA——C B MADD, Monterey, Cal In
this case the improvement is in two-cycle internal combustion engines of that type in which
the photon nerve to separate the expiosion
chambes and operates to compress a charge on
one side of the platen during the explosion and
expansion of the gases upon the opposite side
of the platen.

of the piston.

CARBURGETER. E. F. WHITE, Atlanta, Ga. In the present invention the purpose is for provide a columeter for positively feeding the liquid facel, in a proper mixture, which will very the relations of the mixture inversity with relation to the speed, and without the use of small values.

with relation to the speed, and without the new of annil values. P. Glazaro, New York, N. Y. The various steps of this mechanism of the property of the property of the that the engine is diven continuously. In order to reverse the direction of movement of the radio, the operator grasps a handle and shifts a has to the left. I has steam outers shifts a has to the left. I has steam outers that the relative turn in the opposite disc thea. CWRUTHEREM. — A. Parta, 746 Wood-bridge Read Ipsachs, Suffolk, England. In this instance the invention has reference to improve must be carboneters, the object being to provide a coranter of adapted for use with provide a coranter of adapted for use with gravity or by spring means, A further object to to arrange the device so that it may op-erate in an position—inverted if desired.

Pertaining to Recreation.

Pertaining to Recreation.

COMBINATION POOL AND BILLIARD
TABLE 1 BINNE, New York, N Y In
this pation the invention has reference to pool
and sillland tables, and the object of the improvement is to produce a combination table
having removable embines which can be placed
in the corners and at the side peckets, as
as to transform the pool table into a billiard
table

ALARM PLOAT C. J. Owes, Jophi, III.

Mr. Overa's invention relative to alarm floats, and the aim is to provide one to be used by fishermen, which will sound an alarm when a fish is caught on a book connected by a line with the silarm float. If is wholly needless for a fisherman to hold the line, as be may remain in the yielnity and will hear the alarm.

Ballways and Their Accessories.

RAILHOAD THACK HOLDER AND BRACK.

-1 T West, Bowling Green, by Mems are provided in this invention for security traces, provided by the invention for security traces, which will permit a release of the same when cherry, and the object it to provide a device which may be resulty applied for the attachment of a tall upon a cross fee; which may be resulty applied for the attachment of a tall upon a cross fee; which may be resulty applied for the attachment of a tall upon a cross fee; which may be resulty applied for the reliably secure the track rail and hold it on the leaders of the control of the

on the wheels, so as to bring the train to a gradual stop.

SWITCH-LOCK_C McGritt and A R. Hig.

The lock has a peculiar form of lock, simple, from blanks, and which, therefore, is refused to the switch and the change of the switch and the change of the switch might result in the change of the switch might result in the three change of the switch might result in the higher of the switch might result in the higher of the switch might result in the higher of the inversion is to provide an automatic coupling. Inc. argineed to haute an automatic coupling line, argineed to haute an automatic coupling.

Inc. argineed to haute an automatic coupling for the first of the previous in the purpose on the outer bring succepted, and to ease an the outer bring succepted, and to ease an

emergency application of the fluid pr brakes in case the cars accidentally apart.

re-intergency appliestion of the fluid pressure represents appliestion of the fluid pressure present and the care acceptance of the control of the care acceptance of the care acceptan

equalized
IMAFF EXCITER FOR LOCOMOTIVES.—
3 L. Britoniam, Hoston, Mass. This improvement provides an apparatus disposed in a magnetic disposed in a motiver for limiting the time for starring the free provides means whereby an apparatus may be installed in operative position and raised theoretion, and provides means whereby the apparatus may be maintained in elevated position have been provided by the provided of the control of the condition of

Pertaining to Vehicles.

BFRING-WIREL—2. A. REUMORE and R. I. RELEGORE. CUBErton, Mont. This invention relates to spring wheat to be emplored as substitutes for pneumants wheels in motor cars and other whether. It delicates a distinctive form and arrangement of elliptical spring as well as special features entering into the awdin attracture and the housing place.

rim attractors and the housing place.

WAGON LOADER—A. McKinzer, Berclair,

Texas. The invarious is an improvement in
bounding devices for wagens and has for an oblect, among others, to provide a construction
between the construction of the construction of the construction
and the construction of the wagen may be weighted when supprovided from the foliable devices and then conveniently delivered into the wagen or other receptacle

receptacle WAGON BILAKE—REEN G. DOLAND, Starks-boro, Vermont The invention which is il-lustrated in the accompanying engraving pro-vides an improvement in brakes for wagons and other vehicles. The brake arrangement is used



AUTOMATIC WAGON BRAKE.

to lock automatically with the shoes either ap-plied or released, by a predetermined pull and backing of the wagon togue respectively, and it is adapted to be manually unlocked and locked, whereby the brakes are freely applied and released under the action of the tongue.

Pertaining to Vehicles.
WiGNIS BRAKES.—J. W. FINITY, Hentonia,
Miss. The intention in this care is to provide an efficient brake, connected directly to
the axie and supported entirely by the runeling gear, so that the bed may be removed
without affecting the brake, and wherein all
of the brake mechanism is outside of the load
line, and the capacity of the wagon will not
be decreased.

Designs.

Designs, Designs, Designs, Designs, Designs, Designs, Amonumental Gestall the shade of a rough surface bose, The former is two-thirds the height of the amounts, is rough surfaced on the ends, and is smooth faced in front. An urn with and is smooth faced in front. An urn with a smooth faced in front of the shaft on an edge of the state in front of the shaft on an edge of the state of the right of the urn are polished black tablets for name and inscription.

Note.—Copies of any of these patents will be furnished by the SCEENTIFIC AMERICAN for on cents each. Please state-the name of the atentee, title of the invention, and date of this name.

on States Patent Office will be found to the States Patent Office will be found to the States Supplement.



Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, set. This was a patent of the part of

(12855) H. B. M. asks: Do you know of an appliance that can be applied to a chime of an appliance that can be applied to a chime of the control of the contr

that disappeare the the colors as washed out.

(1956) A. A. S. askr. Our village
water main shows a pressure of To possible 1
have a 3.4-ther plop to first long straight into
my cellar. Is there amough power to this
strain, if rightly applied, to operate a suction
cleaning hose? Could the air be exhausted
from the hose by the "step pump" principle? A.

um cleaner working by water jet was dewrited fully in Scientricz Ammican, No. 19,
vol 99, page 320, and No. 2, vol. 100, page
20, which we can supply at the cents aschmatical. We lear that someone has recently
outlet, in place of the 30-foot vertical drop
leg, and found that it collapses against the
stream no as to act as a cheek and prevent
the air from returning against the stream.
(13569) J. B. McD. askie: Is there

the air from returning against the stream. (12559) J. B. McD. asks: Is there asy limit to the presence that air will receive? then ether be compressed, as if you were pumping ather from one varuum into another vacuum? A. There is no faint to the compense of the control of the

where the course is the countries by any ordimary vessels, since it passes freely through all
(12860) J. M. G. askir. Could a barrel
of water be prevented from from thought of the deinside a box surrounded by savedust? A. Yes; for a limited time, No matter, how good you make your protecting casing, the heat of the
the outside temperature is lower than the
countries of the countries of the countries of the
temperature in the barrel. If the weather
stays coid long enough, the barrel will surely
can only be determined by our from the
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or resistance.

The control of the c

BUT POOR SEC. CHAIR ON ELECTROPIE. By Frank & bent. Philadelphia: 13 E. 12 cott Company. 154 pp. Frank.

COLL COMPANY. I'VE BID. Cream. 8-128The Object of this hook to complishe the fine uncateshated man in simple issuately how size raticity is used at the home, in the Activity, Marking purposes, despisement, telegraphy, wither less telegraphy, etc. There is an introducible control of the co

demonstrated by dispersion of the state of t

Bounder: AND MAGNETERM SIMPLY ExPLAINED. By Alfred W. Maynhall.
New York: Spon & Chamberlain Co.,
paper, 20 pp. Billustrations. Price,
paper, 20 pp. Billustrations.
The object of this book is not to give rules
for calculating magneta, but merely to explain
the principles of magnets and magnetism. It
takes up permanent magnets as well as electromagnets, and gives experiments with magnete,
and written in simple language.
The UNITY OF THE INTERNER. By Joseph

and written in simple language.

The UNITO THE UNITERENE. By Joseph Cossand. Tokyo: The Methodskt Publishing House, 1910. 376 pp. In the effort to bridge the apparent guit between science and religion, the author has been at the second section of the section of th

Company of the Compan

and transformers by which line current may be still under a search of the control of the control

A Nastacket Windmill of 1746 of the aeroplane would constantly in crease to 120 miles an hour or more.

from page 84.) forms the actual grinding, the meal points into a hopper on the floor below.

The grinding shaft is another nove feature of the mill. As already stated, nearly all the material of which it was constructed was "home-made," but even cal was not strong enough to revolve the granite grindstene, as it is a foot the granite grindstone, as it is a foot thick and six feet in diameter, with a hele for the driving shaft only four inches square. Wilbur solved this problem by making a combination shaft. had a har of iron forged in England, of the length required and of a width that would exactly fit the hole in the He set this through the stone, the lower end being buried in the ground beneath the mill, thus anchoring the shaft. Above the grindstone the iron was fastened to the wooden shaft by ciamping the ends together with a heavy

on "collar" or band. The method of applying the power generated by the wind wheel, and the spar and capstan system, are as inter-esting as the way in which the grind-stone is turned. The operation of the spar has already been explained. The cog principle is again used, however, in its connection with the mill. The upper end of the spar, which projects into the mill, is connected in this way with the hub of the wheel, and as the spar is turned by the capstan, this side in the terried by the captain, this shear the the wind wheel framework extends to the center of the driving wheel, and turning by the action of the wheel as driven by the wind, communicates power

the grinding machinery in this way.

As it is necessary to control the force of the wind at times when the velocity of the wind at times when the velocity is too great, and the wheel might be damaged by turning too rapidly, the builder of the mill designed a crude brake which counteracts the force of the wind and controls the speed of the wind wheel when necessary. It consists of a heavy cak beam, to one end of which a box of stone weighing several hundred pounds is attached by a rope and a pul-ley. One man can raise and lower the box, so carefully is the weight adjusted box, so carefully is the weight anjusced.

The end of the beam projects under the shaft extending from the hub of the wind wheel into the mill. It is held loosely in a rope noose, and when it is loosely in a rope house, and when it is necessary to check the speed, the box of stone is loosened and the weight presses down. On the principle of the seesaw, the other end moves up and presses against the wind-wheel shaft. This brake is also used to stop the wind wheel at

night, or when operations are suspended.

The capacity of this mill is ten bushels when operated at its greatest speed. But one man is necessary to rm the operations. The arrangement about grinding corn is a custom handed down from the older days. Farmers bring the grain to the mill, and when it is converted into meal and weighed, it is converted into meal and weighted, each farmer gives the miller three quarts out of every bushel of grain which is ground, or about ten per cent.

Two New French Aeroplanes (Continued from page 85.)

verse stability due to the sig-sag girders which resemble the tetrahedral cell—the at stable form of supporting surface; and (5) case of assembling and dis-assembling of the machine.

In view of the supporting power and stabilizing effect of the trussed girders it is interesting to note that supposing the machine to fly at a speed of 45 miles an hour with the cloth on, it this were respond the girders themselves would theoretically support the 800 jenuals at a pixel of 150 arties per hour. If it were possibles to rest the cloth of the wings while to fight, it would therefore be possible to fight, it would therefore be possible to be on diministrating the supporting contribute until the condition of the supporting contribute until the condition of the support to the support of the suppo red the girders themselves would

Some two or three years ago Santos Dumont constructed a small biplane having its supporting surfaces set at a sharp dihedral angle. Wood was used for the aeroplane surfaces, and it was hought that this machine would be very speedy. The supporting surface was s small in proportion to the weight that it was difficult to attain sufficient speed for a sustained flight, and almost at the first attempt the machine was smashed and abandoned by the daring Brazilian. The Paulhan biplane with reefed wings would be a direct descendant of Santos Dumont's wood-surfaced flier, and the possibilities of the latter machine flying under bare poles, so to speak, give one an idea of the size and speed of the aeroplanes that will undoubtedly be devel-oped in the future.

Mimicry with the Mimic Left Out

(Continued from page 87.) and sucks out the juices. It has been suggested that the monkeys might be the destroying angels who weed out the that do not come up to the stand ard of appearance: but in northern Cevlon, where the monkeys are most abundant, the form of these butterflies that is most abundant is the supposedly "unprotected" one; whereas the protected forms—the "mimics"—occur where the monkeys are scarce.

One particular group that Prof. Pun nett worked with was the genus Papilio One species, P. polytes, has three dis-tinct kinds of females: one of these resembles the male, and of the others each sembles the mate, and of the others each resembles a distinct species of Papilio-one P. hector, and the other P aristolochia. The two latter species are supposed to be the "models," on account of their poisonous or disagreeable juices and their more brilliant coloration

In these, as in other cases of resem-bling pairs examined, the resemblance is most striking when the specimens are prepared (as they are in collections and museums) with the wings spread out showing only the upper surfaces, and generally concealing the bodies. In their natural surroundings, and espe-cially while on the wing, the resemblance is much less; and Prof. Punnett was able, after a short stay on the island, to recognize any of the species that he studied at a distance of from ten to fifty yards, by the appearance during flight, yarus, by the appearance during fight.

It is highly probable, he thinks, that any
of the supposed enemies, brought up
among these insects, should have no difficulty in discriminating between the different species; especially since, according to the doctrine of natural se-lection, the very existence of the enemy would depend upon recognizable suitable material when he sees it.

Some of the difficulties of the "natural selection" theory for explaining the origin of three distinct forms of females in this species, or, for that matter, in any species-and there are many-that

hows females of two or more forms are: 1. Slight variations from the original pattern must be supposed to have suffi-cient protective value to determine that the individuals possessing the particular pattern variation in question should survive in larger proportions than the orig-

2. There are no intermediate forms, such as we should expect to find if the new forms arose gradually through the accumulation of minute difference 3. The frequent absence of the "pro

tective" mimicry among the males
4. There are many species of i that have two or more forms of the or other discoverable advantage

5. It is assumed that minute variations of all sorts can be inherited; this has not been demonstrated.

Prof. Punnett suggests an explanation for these "missicking" females that is



Dewar Trophy Cadillac

We in America are sometimes accused of unduly acclaiming our own achievements

As a matter of fact, we are singularly indifferent about our own accomplishments.

We make a seven-days' wonder of our engineering trumphs, and then-forget them

In England, they are still discussing the fact that a moderate-priced American motor car won the world's trophy for fine manufacturing, two years ago

And, in reality, that was an achievement worth while.

That America should invade the old world—and give that old world an object-lesson in standardization was significant

It was significant, because standardization menus prinstaking exe-—mens devoltos to secunicly trivial details—menus measure-ments minute bevond optical perception—menus, in short, the very things in which American manufacturers have been as-sumed, by their continental critics, to be more or less shiftless

These qualities, embodied in the Cadillac, were a source of sur-prise abroad; because they were scarcely expected in an Ameri-can product.

The subject has recently been revived by British technical write and it is of interest to every man who owns, or contemplat owning a motor car.

Any motor car which does not incorporate to a greater or less degree the precise qualities which won the Dewar Trophy for the Cadillac is not, in the last analysis, a good value for the money it costs you.

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---because they eliminate looseness, ill-fitting parts, wear, and

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From numerous cities come specific reports affording conclusive proof in this respect, but the tabulated figures from these cities are increly typical of the experiences all over the world

And, we repeat, these accomplishments all bark back to the same qualities which won the Dewar Trophy

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There is valid reason why you should bear it in mind when you come to buy a motor car.

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of the laws of heredity. If we suppose that the divergent types of females arose as sudden "mutations" or sports from the found in Vulcano, one of the Lipari Isles. original type, it is easy to construct a scheme of the hypothetical constitution of such individuals, from the point of view of heritable qualities, which would tures show not only how the new female char-acters would be continued in accordance also how the original form of the female -that resembling the male-would be eliminated in the course of time. sure, such a scheme, being purely hypothetical, proves nothing and must be a jected to the test of experiment, which takes time. But experiments already made in the breeding of insects—some ost aggressive de by E. B Poulton, the n fender of the natural selection theory as applied to mimicry-are not in con-flict with Punnett's theory.

If there should arise by mutation a form that was incapable of maintaining itself under the conditions of its environment, this form would of course be elim- erals that occur in Sweden, Greenland inated by the action of natural selection. But under the circumstances Prof. Puna mutation shall not have any characters that are harmful; it is possible to look upon the existence of the various forms as due to the absence of 'natural selection" or any adverse conditions selection In other words, natural selection may play a part in the conscruction do with their origin.

Metals More Precious than Gold

(Continued from page 88)

hard, and are used for pointing pens.
Metallic iridium possesses a white,
steel-like appearance. The knife edges balances and other bearings that require extreme hardness are ofter made of it. An alloy of ten per cent iridium and ninety per cent platinum has been found to be little affected in volume by changes of temperature, and is the substance of which the standard eter, kept in the International Metric

Bureau at Paris, is made. Rhodium and ruthenium are metals comparatively little practical use. former occurs in platinum ore to the extent of five per cent. The latter is found only in osmiridium, and averages about five per cent of that metal. The six metals mentioned are gen

ally treated of together because of their esemblance to one another. The metal that really ranks next to

platinum in value is zirconium, which occurs in hyacinth and some other rare minerals. Titanium and uranium, whose ores are found in Cornwall England e other places, are slightly flore costly than sirconium. Uranium is remarkable for its high atomic weight. Another costly metal is lithium. Tte salts are widely distributed, being found in very minute quantities in the ashes of many plants, especially tobacco.

dium, the ores of which are also very widely distributed, occurs, accordto one authority, in all primitiv nite rocks, but in small quantity. is difficult to obtain in a state of purity, and is of value in processes connected is of value in proce with the manufacture of steel.

The next metal is barium, concerning the appearance and properties of which much difference exists among chemists. Rubidium and cosium were the first of a number of elements whose discovery irectly due to the introduction of spectroscopic analysis. They are widely diffused, but in such small quantities that their presence has been undetected by thods of analysis previously in use. One mineral spring in Cornwall was shown to contain about one and one-half parts of casium in one million.

as the richest sources of cashum recently, when both it and rubidium m witti Rubidium occurs as silver-white globules of metal. Cosium is also of a silver-white color, and is soft at ordinary tempers

Another metal whose discovery is du s would be continued in accordance to the spectroscope is gallium. It is well-known Mendelian laws, but bluish-white in appearance, and is easily In fact, it can be liquefi ing it between the fingers. When rubbed on glass it forms a mirror much superior to the ordinary mercurial one.

Next may be mentioned a g teen metals, usually known from their analogy to the most important of their number as the cerium metals, many of which are extremely rare and valuable. They are cerium, yttrium, lanthanum presendymium, neodymium, terbium ytterbium, erbium, holmium, thulium dysprosium, decipium, samarium, scan dium, and victorium. The cerium metals are chiefly associated in groups in min and some parts of Siberia. Three metal that sometimes accompany them are thorium, niobium, and tantalum; but they are not classified with them because of the dissimilarity of their properties. These metals do not occur in commerce to any extent, with the notable exception of tantalum, which has been utilize manufacture of electric lamp filaments. Generally speaking, the cerium metals may be held to be mere chemical curionities

Within recent years the most notable additions to the catalogue of metallic elements are radium, actinium, and polonium, whose existence remained un suspected until science began to experi ment with the Röntgen and Becquerel rays. So much has been written of these, that it were superfluous to treat of them, especially radium

American Aborigines

(Continued from page 89.)

stature, yet possessing remarkable strength and endurance. Their skin is a light brownish yellow with a ruddy tint on the exposed parts. Their hands and feet are small and well formed. eyes resemble those of the Mongols, and this fact has induced many students to classify them with Asiatic peoples.

Among most Eskimo trib

tattoo their faces, and some of the Alaskan tribes wear studs in opening through their cheeks. To a certain extent the Eskimos practise both polygamy and polyandry, but a second marriage is unusual where children have been born of the first wife. Their religious cult is curious They believe in spirits inhabiting animals and inanimate objects, but chief deity is an old woman who is said to reside in the ocean and has the power of wreaking vengeance on her mortal subjects by causing storms to arise, etc., if any of her laws are in-fringed. The central tribes believe that a man's body is inhabited by two spirits one of which stays with it when it dies and may temporarily enter the body of deceased, while the other spirit wings its flight to one of the many lands reserve for the souls of the departed. Groups of North Greenland Eskim

(Smith Bound) and western (Alaskan) Eskimo are here illustrated.

The first depicts a phase of family life at Smith Sound as it might appear in the spring, moving across the ice fields. The young man, having clubbed a small heal, has called on the sledge party to haul it home. He is laughed at by the elder man, who doubtless asked him jokingly why he couldn't have carried it home on his back. The fact that they use. One inities spring in Correction of the first state of the second of the was shown to contain about one and one, were unnecessarily delied suit to perform that parts of cessium in one million. A the task of bringing this tittle seal home similar spring in Durkheim, Bavaria, on a siedge did not irritate them; for, contains one and one-half parts in ten strange as it may seem, these chepts,

more in accord with what we now know millions, and these have been regarded living farther porth than any oth tsolated from everything that we remu as making life pl are ementionally cheerful. The wome who carries a baby in her hood, is about to help in attaching the seal to the sledge. A girl is playing with the dogs while a little boy is seen clinging to the

back of the sledge.

The second picture shows the typical western Eskimos, who inhabit the at of the northwestern seas from the mouth of the Mackentle River around Alaska to Mount St. Elias. The woman with a child is dressed in caribou skins, while the one on the right, from Bristol Bay, is clad in marmot skins. The man, from the region of Norton Sound, is dressed in caribou and holds a barbed harpoon in his hand.

We now take quite a jump, from Eskimo land to the Great Plains, where live the Sioux, Algonkin, and Kiowa tribes. In taking this leap we pass over, with only a sentence or two, the Chilkat Indians of southeastern Alaska and the Hupa Indians of northwestern Califor nia, as it is impossible to notice evers type in a brief article of this kind. The ormer do commerce with the Athapascan tribes to their east, from whom they can tribes to their east, from whom they obtain the horns and wool of the Arctic goat. The women weave the wool into the famous Chilkat blankets, the designs of which are inserted separately, as in the Gobelin tapestry. The Hups Indians live on a mixed diet of meat, fish, and acorns; they dress in deerskins and are very fond of personal adornment. of their most important industries is the harvesting, transporting, storing, and milling of acorns, as well as the preparation of food from the meal

The next picture shows a Sioux family, whose activities depended largely on the buffalo, from which were derived their food, dress, tents, tools, and ever their folk-lore and religion. In th ture is seen a man returning from the chase; his wife is dressing a hide; the young girl is beading a moccasin for her sister, while the small boy, with a bow and arrow, is toddling forward to welcome his father.

In the Pueblo province the Navahos are conspicuous They are especially interesting, since it was under Spanish direction that they laid aside their wild hunting habits and became herdsmen of sheep and other domestic animals, and learned to weave and work in metals. ments of iron, shaping some silver ornaments, which they are very skillful in The women engage in their working. most notable industry, i. e., spinning yarn from native wool and weaving blankets As intimated, the Navahos have become adept in various industrial ccupations. An interesting account of their work in tanning and shoe making was published in Volume XI. of the Proceedings of the National Museum, while their skill in belt weaving is described in Volume XIV. of that series, and their advance in house-building methods is subject of an article in Volume XV.

We next come to the Zuñi Indians, who live in pueblos on the tablelands of western New Mexico. They were visited at the beginning of the sixteenth century by the earliest Spanish explorers, and their arts and industries, re-ligion, etc., were critically studied some years ago by Mr. Cushing and Major Stevenson of the Bureau of An Ethnology. Later, Mrs. M. E. Stevenson has continued these studies, and a number of excellent papers on this tribe, by these investigators, have been lished in Volumes II., III., IV., V., haned in Volumes II., III., IV., V., XII., and XVIII. of the Reports of the Eureau of American Ethnology. A group not represented here includes in the foreground a young woman engaged in weaving an artistic belt. At the right is seen an old man drilling a bit of stone with a pump-drill. His contume is that wore during the Spanish pe Near the strictle of the proof state

girl, just returned from the spring had beering a water vessel on her head. me her hand to receive a bewl from hae alder stater.

THE SECOND SECON

With the above group we leave the United States and take up for a hasty represented in the next picture by a group of Cocopa Indians, of the Sonoran seven of Coccept Indians, of the Sollorian ethnic province. They occupy the lower valley of the Colorado River in Mexico from the international boundary to the seed of the Gulf of California. They were visited by the Spaniards as early as 1540, but retained their primitive characteristics up to about 1890. They canracteristics up to about 1880. They subsist largely by means of agriculture, feeding partly on game and fish, with various seeds, fruits, and roots. They dwell in scattered settlements, usually containing from one to shout six houses They wear but little clothing, the mer until recent years using only skins, while the women dress in petticoats made from the inner bark of the willow. They habitually paint their faces, and are also tattooed to a moderate extent. In the picture is seen a young man with bow and arrow engaged in teaching a boy to shoot. The woman is pounding, corn in a wooden mortar, while the young girl carries the baby and is evidently interested in her brother's lesson in shooting.

Again traveling south we reach the Maya-Quiché tribes of Indians in Gustemaia. They also occupy parts of Chiapus and a small part of western Honduras. These Indians were at one time the most highly cultured of all the native peoples of the Western Hemisphere. They dressed in delicate fabrics, built huge terraces, and stepped pyramids surmounted by buildings adorned with soulptures and paintings. They were distinctly an industrial and artistic people. Their paintings and sculptures treat of religious subjects, and are re markably free from scenes of blood and slaughter. At the present time there are several hundreds of thousands of there The family group here shown includes a rms with his staff, bearing a net filled with fruit, a woman working at the mill, another woman carrying a basket of fruit in her right hand and a gourd bowl in the left, while the girl walks by her mother, holding a decorated gourd vessel of globular shape.

Another interesting group of Mexican and South American Indians follows. It consists of three figures, a woman from Oaxaca, in southern'Mexico, and two men representing the Piro and Jivaro tribes of the headwaters of the Amazon. woman is dressed in a skirt of striped native-woven cloth. The upper part of her body is covered with a tastefully decorated tunic and her head is pro-tected by a long sash or "veloso." In her left hand is a red earthen drinking cup, while in her right are two gourd The man on the right is a Piro of the Arawakan family, which is of special interest because tribes speakor special interest because tribes spear-ing the same language were met with by Columbus on his first yoyage to America. The man at the left belongs to the Jivaros, who live on the headwaters of pany. the river Marason. His feather skirt and head dress are tasteful and brilliant, ornamented with teeth, bestle wings, and seeds. The elegance of his costume hardly comports with the fisrceness of his nature, for this is one of the most any nature, for this is one of the most aggressive of all Indian tribes in South-America. They are the famous head-hunters, and one of their horrible cus-toms is to preserve the dried heads of

we saw recture shows a group of the ithe edges of the shell. Known as "feet rehated indians. They live on the or "news." The biggest turtle does not blade, and desert areas of the southern furnish more than sixteen pounds of seat of Stangerish. They dress in the shell. Formerly the undershell was discing of simulation, make their testir or savided as worthers, but now it is much within from the latest of the same, esteemed for its delicety of coloring, struck, said five on minimal thank. Their demention of tertices shell is set that the same of the sam

Indians of the United States. They hund the guanaco, the American ostrich, and other animals on horseback. The group shows a family just breaking camp man, wearing a robe of skunk-skin, with holas in his hand is ready to mount his horse. One woman has already mounted, and the boy is assisting in completing her outfit. The second woman is rolling up skin robes of the household, while the little girl is haltering the pet ostrich, the baby meanwhile sleeping in its cage like cradle

A New Metal for Aeroplane Construction From Our English Corresp

One of the chief chemists in the labora-tory of Messrs. Vickers, Sons & Maxim, the well-known British armament manufacturers, has recently perfected an aluminium-alloy which has the strength of mild steel, and which is only slightly heavier than aluminium. This new alloy, to which the generic name "Dur-alumin" has been applied, is especially suitable for the frames of aeroplanes and the cars of dirigible balloons, where combined lightness, great strength and toughness are so imperative; and inasmuch as this firm is now actively enmuch as this nrm is now actively en-gaged in the construction of aerial ves-sels, it is being extensively utilized in connection therewith. The alloy contains upward of 90 per cent of alum inium, has a specific gravity of about 2.8, and a melting point of 650 deg. C. (1,202 deg. F.). Its physical properties are secured by special treatment which is well under control, and may be obtained for any purpose for which it may be required with a tensile strength of 40 tons per square inch with very little elongation, from 28 to 30 tons per square inch with 15 per cent elongation in 2 inches, or 25 tons per square inch with an elongation of about 20 per cent in 2 an elongation of about 20 per cent in 2 inches. Although primarily evolved for the rigid parts of serial vessels, it has been found that the alloy is eminently suited for the fabrication of any article executed in aluminium, either usually for military, domestic, or commercial purposes where a great economy in weight is of vital importance. The al-loy will also take a polish equal to nickel plating, is unaffected by mercury. and is non-magnetic, while it is proof against atmospheric influences and but slightly susceptible to the action of sea slightly susceptible to the action of sea or fresh water. For electrical apparatus it possesses many possibilities, emits when struck a clear silver tone, and is suitable for sound producing apparatus such as bells, organ pipes, etc. The al-loy is obtainable in its finished form for whatever purpose it may be required such as rivets, plates, sheets, wire, strip, and so on, but is not recommended for castings. The Vickers, Sons & Maxim Company has erected a special factory sear Birmingham for its production, which has been placed in the hands of one of its subsidiary connections, the Electric and Ordnance Accessories Com-

Tortoise Shell

The finest of tortoise shell is said to be that which comes from the Indian Archipelage, although much of that obtained on the Florida coast is of the very tained on the Florida coast is of the very best quality. There are three rows of plates on the back of the animal, called "blades" by the fishermen. In the cen-tral row are five plates, and in each of the others four plates, the latter contain ing the best material. Besides these there are twenty-fire small plates round the edges of the shell, known as "feet" or "noses." The biggest turtle does not

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Hydro-electric Development in Maine. -Plans are on foot to build a large hydro-electric plant on the Kennebe River at Moosehead Lake. The ultimate rapacity of the plant will probably be 100,000 horse-power. The power thus produced will be employed for manufac turing and lighting purposes within the State of Maine. The company owns the rights between Moosehead Lake and The

veloping 230,000 horse-power.

less Telegraphy." Braun patents belong to this organiza-tion. Stations on the North German Lloyd, Hamburg American, and other German lines have heretofore been op-erated by the Marconi and Telefunken companies jointly, but now they will be in the hands of the new organization, cause of the Marconi rights owned by the Belgian company.

Weight of Car Motors. - Most of the ower consumed by an electric car is employed in accelerating or getting itself under way, and as such work in-creases directly in proportion to the weight of the car, it is quite essential that all unnecessary weights be reduced For this reason considerable attention is being paid at present to the designing of car bodies in such a way as to reduce the weight to a minimum. The weight the motors is also being investigated. The Electric Rashway Journal in a reent comment on this subject, pointed to the advantage of using commutating pole motors and the necessity for better in-sulation with an artificial means of ventilation It also called attention to the tilation of copper for the field coils. Another method of reducing the weight consists in using higher armature speeds with

double-reduction gearing.

Neon Vacuum Tubes.—Neon appears to give remarkable results when used for vacuum tubes for lighting purposes The rarefied gas produces a strong light, as 's brought out by M. Georges Claude However, it is very difficult to prepare such tubes, as neon loses its effect when in presence of a small amount of other gas Thus a small per cent of nitrogen lov the light quite appreciably, so that he cannot simply introduce even pure neor into a vacuum tube, for the gases given off by the electrodes and the sides of the tube when the current passes will cut down the light almost entirely. To over ome this, he uses Dr Dewar's principle of absorbing by carbon at a very low tem perature. Carbon is placed in bulbs con-nected to the tube and kept very rold so that all the games are absorbed but the neon and n little hydrogen. It often requires a long treatment to thus "form the tube, and finally a fine orange-colore the tube, and finally a may removed. The car-light due to the neon appears. The carlight from the neon tube is very strong and contains a large amount of red rays being thus the opposite of a mercury vapor tube. He uses a tube with a twenty-foot distance between electrodes and two inches dismeter. Only 1,000 volts is needed, compared with 8,000 volts for a nitrogen tube. It gave 1,330 total candle power, consuming 850 watts or 0.64 watts per candle power. No doubt this value will fall much lower

after experiments.

The Water Power of Canada.—An of ficial ceilman of the water power in close of last year, 41,000,000 cubic yards of loss of last year, 41,000,000 cubic yards also of being developed at 25,000,000. Of York State Barge Canal, and 1,000,000 this, the Province of Quebec owns the cubic yards of concrete had been laid. of excavation and been done on the test York State Bayes Canal, and 1,100,000 cubic yards of concrete had been laid. Each of these quantities is about 40 per cent of the total amount required for the finished project.

> Thermit Rall Welding, -The Holyoke Street Railway Company has done some successful thermit welding; which it is believed will provide the much desired absolutely continuous rail. The rail ends, spaced % inch apart, are first heated to a red heat, when the moiten steel resulting from the thermit reaction, is poured into the mold. The surplus metal the rail is removed, and the joint sur-faced off by means of a grinder.

Dangers of Railroad Traspassing.— Since January 1, 1990, trespassing on the Pennsylvania Railroad in violation of the Wireless Combination in Germany.— In which is the different wireless companies of plc, an approximate rate of two each uny. All the different wireless companies of a the company of Brussels, have company of the "German Operating Company for Wire-loss Telegraphy." The Telefunken and 743 in 1908, to 633 in 1909, and to 585 in 1910, a reduction of 30 per cent in four Venre

> To Prevent Defilement of Harborn Captain Winslow, U. S. N., supervisor of the harbor of New York, in his annual report, proposes to prevent the defilement of the harbor by floating and unsanitary debris by the use of a deck scow, which will prevent the escape of light rubbis as it is being towed out to sea. He also proposes stricter supervision of scow masters who go to see in rough weather and, to save their craft, dump the load wherever they may chance to be.

Water Tanks to Prevent Rolling.— Kaiser Wilhelm has congratulated Di-rector Frahm, of Hamburg, upon his invention to prevent ships from rolling. The apparatus consists of U-shaped tanks extending through the hold transversel from port to starboard. The water rise and falls as the ship rolls, with the re suit that the rythmical movement of the vessel is overcome. In actual tests with steamers the rolling was reduced from 11 degrees to 2 degrees.

Anti-Acroplane Gun.—An interesting development in guns for the attack of aeropianes is the McLean-Lissack automatic machine gun, which is capable of firing at war-balloons at an elevation of 75 deg. at the rate of 350 shots per min ute. The mechanism is gas-operated, and the piece referred to is mounted on a tripod, with sufficient clearance to allow the operator to lie on the ground and aim by direct sighting at the balloon or

aeroplane. Automobile Economy. -- In a recent lecture, William H. Stuart, Jr., showed how largely the fuel economy of an automo bile depends on the skill of the driver He instanced a consumption test made by him over a measured course. In the first test the machine was driven by a driver thoroughly conversant with the mechanism of an automobile. The sec ond test was made with a novice, who operation, such as are given to a me when he buys a car. The results show that 34.7 more fuel was used by the fr experienced driver.

Elevated Freight Road for New York -The plan of Calvin Tompking Co missioner of Docks and Ferries, for the improvement of Manhattan's west water front, has met with ge proval. The plans contemplate track elevated rallyond to est Fulton Street to Sixty-third B a series of terminals. Short lead into new terminals construct the east side of the street. Freight be transferred between track care of the new line, and it congestion which new arises Street would be available.



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Aeronantica

Paulian Wins the Daily Mail Cross Jountry Prize.—Paulian received a shock of 25,000 france from the Daily Most recently, as he was declared the winner of the prize for the greatest distance flown across country for the year anding with August, 1910. He also won the \$50,000 London to Manchester prize effered by this newspaper, which, all told, has expended \$60,000 in prize money, all of which has been captured by the French.

Appropriation by the House.—On Tues appropriation by the house.—On the day of last week an appropriation of \$375,000 was passed by the House with the stipulation that \$125,000 of this appropriation must be used for equipping the Signal Corps with aeroplanes. Repthus bringing it before the House. He proposed an appropriation of \$250,000 and told how far behind the European powers our country is at the present time in the matter of aeronautics. He called attention to the appropriation of \$2,600,000 for dirigibles and aeroplanes and bases from which to operate them that has recently been made by Italy. Representative Mann was obliged to cut in half his appropriation for aeroplanes, the stipulation mentioned above. It Senate, and that Brigadier-General Allen, sounce, and that Brigadist-deneral Alich, terest in this development of weather the chief of the Bignal Corps, will be able to carry out his plan of seroplane hardly be doubted that it will enter the stations with twenty machines in difpractical stage in a few years. ferent parts of the country.

mann, the young American aviator who has made many records in France, few from Rheims to Mourmeion and back, a nelevation of 4,720 feet above sea level, total distance of about 40 miles, with two passengers. He made the outward trip, symptoms of anow blindness. On entering the temporary of the second of the return fourney in the afternoon down the return fourney in the afternoon down the second of the return fourney in the afternoon down the second of the return fourney in the afternoon down the second of the secon was covered in 29 minutes. This is a record flight with three men in a machine. Weymann used a Farman biplane with which has been made to their gloves and shoes, and with which has been made to their gloves and shoes, and with which has been made to their gloves and shoes, and with which has been made to their gloves and shoes, and the statement of the statemen come. Weymann used a Farman biplane with which he has made most of his and shade on all parts of their persons of the natable paragraphy fights and clothing. The effect soon vanished with which he has made most of us and clothing the effect soon vanished the chief of which are the flight from with mourmelon to Paris (105 miles) last September and his cross-country flight for the Michelin Trophy from Paris to Wood describes in the South African Development of the Michelin Trophy from Paris to Wood describes in the South African Development of September the re-Puy-de-Dome mountain, in which he flew Journal of Science for September the re 280 miles with a passenger He almost markable snowsterm that fell in South reached the goal, but was compelled to Africa, August 16th-18th, 1909 The ares descend within a few miles of his destitation because of a dense fog. At one of the Transvani, the northwest of the titme last summer he held the altitude Orange River Colon), and the higher ecord with 4,100 feet.

Kly's Flight to the U. S. S. "Pennsyl-"Pennsylvania." which was anchored in the midst of the shipping of the harbor. A special platform 120 feet long and about 40 feet wide had been erected on the stern of the vessel and canvas shields had been stretched on each side to catch the machine in case it did not land upon the platform. Ropes were stretched across the platform and connected with bass of sand in order to stop the aeropage or sand in order to stop the sero-plane in case the special skids with hooks did not work. Ely left the field about 10:30 A. M., climbed 2,000 feet, and crocsed the San Bruno hills at a great height. He headed straight for the warship, shut off his motor while some dis-tance up, glided down to the platform, sance up, guided down to the pastiorin, and landed with perfect besse. He had so little trouble in making the landing that he believes he could do it nine times sut of ten under moderate weather con-

Science

The Quantity of Atmospheric Water .-The Weather Bureau has made progress toward the installation of apparatus, es pecially optical, for the study of the quantity of water vapor through a wide verti cal extent of the atmosphere (as distinguished from the purely local indications of the hygrometer and the psychrometer) Spectroscopic observations with this end in view are to be undertaken by Prof W J. Humphreys.

A Definition of Exercise.—If you want a definition of exercise, you will find it in an address read by Dr. Albert E. Sterne before the Ohio Valley Me Association. Under the term exercise he includes "all volitional impulses leading essentative James R. Mann, of Illinois, to active bodily effort great or small "
ffered an amendment to the army bill, Of course he leaves out of consideration "such of them as fulfill merely the neces sities of our daily existence as such, also all passive motions which aim at merely therapeutic ends."

Wireless Weather Reports.-Wireless weather reports from ves sola era now by ing transmitted regularly to the Central Meteorological Observatory at Tokyo, and warnings of typhoons and other storms are issued to vessels from that institubut be finally succeeded in raising the tion by the same means of communicaoriginal appropriation of \$250,000 for tion. In spite of the rather discouraging Signal Corps equipment to \$375,000 with results of the experiments made with tion. In spite of the rather discouraging wireless last year by the English and te be hoped that this bill will pass the German meteorological services, the interest in this development of weather practical stage in a few years.

A Singular Light Effect, -A peculiar France.—On January 17th, Henry Wey-mann, the young American aviator who has made wang American aviator who day in fog and lightly falling snow at an elevation of 4,750 feet above sea level,

covered by the storm embraced the south parts of Natal On the morning of August 17th, the town of Johannesburg, for vasis."—On January 17th Eugene 21 the first lime in its history, was covered made the 12-mile trip from the aviation with snow to a depth of several inches field at San Francisco to the warship of the inhibitory, or many of its inhabitants, especialized. To many of its inhabitants, especially of the younger generation, the sight of snow was quite new, and the unusual was celebrated as a general holiday. During the past sixty years there have been only three great snowstorms in the Transvaal, including this one.

Seasonal Snowfall. - During the pas-two years the Weather Bureau has been experimenting with various devices for measuring the seasonal snowfall regions remote from human habitation, where it is impossible to make daily observations. This problem is most import ant in the western States, where the water used for irrigation in summer depends upon the snowfall of the neighboring mountains during the winter. most satisfactory results have been ob-tained with what is known as a "snowbin"-a cubical box five feet on a side suc or ten under monerate weather con-linitions. After a reception (e. altiphoard to EU returned by seroplane to the field standing on a frame so that the top is in 16 minutes. This was the second time in feet above the ground. The bin is he had started a flight from a naval study and the started of the started of the started of the top revent the wind from blowing the water, but he search off with no out the snow and to insure a level deposit within. within.



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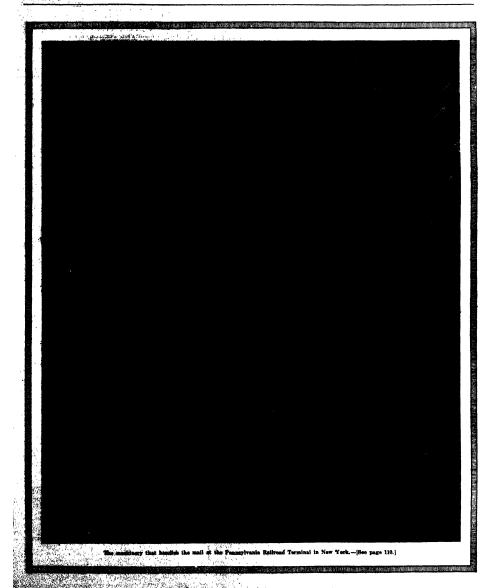


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NEW YORK, FEBRUARY 4, 1911

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SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, FEBRUARY 4, 1911

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The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fuscination of science.

Larger Ships-Longer Piers

HE War Department may as well try to stem Niagara or set back the clock, as to pre-cept of New York a little farther into the Hudson River to provide suitable accommodation for modern steamships. The jealous care with which the army steamships. The jealous care with which the army engineers protect the public waterways against private encroachment is one among many com-mendable evadences of the unshakable fidelity with which thus fine body of men has ever fulfilled its trusts. The soundest principles, however, may sometimes be too rigidly applied. We believe this matter of pier extension is a case in point. To set a limit upon the length of the New York puers is arbitrarily to set a limit too the steadily increasing size of the occan stramblin. This would be to size of the ocean stranship. This would be to arrest a material development which is taking place in accordance with a broad fundamental law that

in accordance with a broad fundamental law that underlies the whole question of transportation, whether on land or sea. If the motives which prompt the construction of such giant ships as the "Olympic" and "Titanic were merely of a spectacular or advertising character, the War Department might be justified in its refusal; very properly holding that the interests of the public in a great national fairway are a vastly superior consideration to the mere commercial rivalry of a few steamship companies. The secret of the large ship, however, lies much deeper than this. It is due to the fact, well understood by all this transportation, that the larger the single students of transportation, that the larger the single unit, whether it be freight car, motor truck, or unit, whether it be freight car, motor truck, or river or occan steamship, the smaller the cost of transportation of a given number of passengers or bulk of freight. To this, in the case of the steamship, may be added the important fact that the larger vessel is always the more comfortable and ever the more proof against disaster.

A few years ago, when the "Lustiania" was make

A few years ago, when the "Lusilania was making her early younges, the writer happened to be a fellow passenger with the builder of that famous ship, who was making the trip for observation of her performance. In reply to a question as to whether the expected advantages due to the great size of the vessel had been realized, the answer was given that the results had exceeded expectations, and that if the piers and channel depths were available, the orders for new ships of the largest dimensions would specify a minimum size of one thou-

saud feet.

Had Nature drawn the lines of New York barbor upon a less generous scale, the objections of the War Department to 900-foot piers would be more to the point; but, as we have shown claewhere in this issue, Jamong the five principal parts of the world, in respect of the width of its fairway and the gample room for the maneuvering of ships of large size, New York stands in a class by itself. As a matter of fact, the new piers could be made

one thousand feet in length on the Manhattan side of the river, and still leave a width between opposite pierhead lines that would be over 25 per estat greater than the width of the next largest channel among the leading ports, that of the River Mersey

The Need of Fog Investigations

NYONE who has experienced a genuine "London particular," with its paralysing effects on everybody and everything except the gas and electric lighting companies, realises how important a part is played by fog in the economy of the world's metropolis. In fact, throughout the British Isles the problem of fog is a serious one, and British meteorologists have accordingly paid much

attention to it. Some years ago the editor of Symona's Monthly Meteorological Magazine undertook to compute the expense for which London fogs were responsible during a single season. On a single day of heavy fog, one of the London gas companies furnished gas in excess of its normal consumption for that date to the value of \$15,000. Adding the payments to other gas companies, extra electric lighting, lamps, damage to goods and vehicles, and the loss occasioned by the suspension of traffic, it was found that the cost of a single day's fog amounted to from \$80,000 to \$60,000. The corresponding expense for the whole season was put down at approximately \$800,000 and \$100,000. The corresponding expense for the whole season was put down at approximately \$800,000. \$600,000

Considering the heavy cost of fog to the British taxpayer, it is difficult to understand why the British government has not more liberally encouraged the scientific investigation of this element and experiments directed toward finding the means of com-

the scientific investigation of this element and experiments directed toward finding the means of combating it.

In 1901 an inquiry into the occurrence and distribution of fog in the London district was begun by the Meteorological Council, in response to an application from the representatives of various elements of the substitution of the process of the control of the representatives of various elements of the general probability of fog it the meteorological conditions in the south of England are recognized as favorable for its occurrence, but more specific forecasts were desired with reference to London, and, if possible, to parts of London. The London County Council was asked to contribute to the expense of this undertaking, and did so to the meager extent of £250. This amount was expended in the course of the winter of 1901-1902, and the first trustworthy detailed statistics concerning the distribution and frequency of fog in London, and the conditions under which it is formed, were such as the county Council declined to make a further grant of funds, the "London Fog Inquiry," as and as the County Council declined to make a further grant of funds, the "London Fog Inquiry," is that since been called, was left "a block in the quarry."

The short-teinted action of the London authori-

quarry. The short-sighted action of the London authori-ties in this matter is, unhappily, representative of the attitude of English officialdom toward scientific investigation. As a rule, scientific research in Eng-land, when it succeeds in getting official recognition at all, is carried on with such slender means as we in America would consider about sufficient for sta-tionery and incidentals. The small government grant is sometimes eked out with a smaller contribution from the British Association or the Royal Society: and the fact that, under such conditions, brilliant could are frequently achieved, hears witness not only to the genius and industry of English men of science, but also to their admirable spirit of self-

only to the genius and industry of English men or science, but also to their admirable spirit of self-sacrifice.

Sir Oliver Lodge is quoted as having said, in a recent lecture, that if the British-nation would grant £100,000 a year to the universities for experiment, he would apply electricity not only to accelerating plant growth, but to dispersing og and inducating weather in clouds and rain. The experiments already made in France and elsewhere in the use of Hertsian waves to dispel fog, if not conclusive, are at least encouraging; and several other agencies, such as jets of hot air, have been applied with more or less success to effecting the same purpose within a limited area. The problem is, of course, of worldwide interest; as witnessed by the many accidents constantly occurring on the high scass as a result of tog, to say nothing of the enormous amount of time lost by vessels traveling at reduced speed to avoid such accidents. This subject is therefore a legitimate field of inquiry for every government that has the machinery of sclentific revearch at its disposal, as well as for such non-official institutions of systems of the property of sclentific revearch at its disposal, as well as for such non-official institutions of systems of the property of sclentific revearch at its disposal, as well as for such non-official institutions of systems of the property of sclentific revearch at its disposal, as

Power from Solar Estimation

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awakened considerable interest among our real A. Willisation of the cause heat second the have awakened considerabile interest among one randens, if we may judge by the correspondensis received. This correspondence is published expeatedly in the regular place in the present issue. The communications received are of varied character, and me in part critical. The one which naturally claims first attention is a letter from the author of the paper commented on, Prof. R. A. Fessenden. He draws attention to the fact that Prof. Very in the London Philosophical Magazine reserved the attainment, by direct impediately in commenting, which is thus very considerably in excess of that quoted in the subtitle of our article. We gladly take this opportunity of correcting this figure. The project which Prof. Fessenden has taken in hand is certainly one of peculiar interest, and the results of his efforts will be awaited by us and many others with much curiosity. It does not seem possible, from the data in Prof. Fessenden's original paper, to draw any positive conclusions. After all, the final, perhaps the only reliable text in such matters, lies in actual experiment on a sechnical scale. Of nnat, persaps the only reliable test in such maximum, lies in actual experiment on a technical scale. Of the conditions and results of such test Prof. Pages aenden has not given sufficient information to enable us to follow in detail what has been actually achieved us to follow in detail what has been actually achieved at the present time. But the general interest of the problem attacked, and the ingenuity displayed by Prof. Fessenden in his efforts to wrest an-other victory from nature, and to harness in the service of man some of that vast stream of energy which we are allowing to go to waste every day— these stand beyond dispute.

Some Recent Feats of Flying

Some Recent Feats of Flying

I packs well for the future of aviation as a practical art that the efforts of the airmen are being directed in increasing measure to the accomplishment of feats of a practical nature. Particularly mentiorious is the work being done locally of the Scientific American Trophy, and his associates. Carrier American Trophy, and his associates. Carrier aviation field near San Francisco, out over the water to the cruiser "Pennsylvania," where he made a successful lasding on her deck, was one of the most difficult and credible acroplane performances whe gave a dramatic touch to his achievement by starting from the deck of the cruiser and flying back to the aviation ground. Naval men will appreciate the significance of this performance, as bring-ciate the significance of this performance, as bringback to the aviation ground. Navai men will applicate the significance of this performance, as pringing the acropiane scout a long step nearer that stage of its development at which it can be recognised as a reliable and extremely valuable adjunct of the scouting forces of a flect.

It is conceivable that conditions may exist when the might be difficult on the convenient of the

It might be difficult, or not convenient, for the aeroplane to land directly upon the ship; indeed, many naval men consider that it should start from acropiane to land circuly upon the ship; indeed, many naval men consider that it should start from and alight on the water alongside the ship and be lifted aboard by the ship's holeting gear. In cain or fairly moderate weather, such starts and landings might be made without mishap; but where the sea was rough, or even broken by short, choppy wears the present type of aeroplane would find it impossible, either to get away from the water, or to come down upon the surface without mishap. At the high speed necessary for rising or landing, the hammering effect of even small wave would be as serious as to wrock the light postoons or shells which this the attached to the machine. On noot of the days of the year, however, the sea would be assisted to the started of the machine. On noot of the days of the year, however, the sea would be sufficiently quiet for the purpose; and we note that Curities, a few days age at San Diego Bay, successfully accomplished the double feat of starting and landing, rising to about 100 feet above the water, and after covering a circultous roots, returning and after covering a circultous roots, returning and

landing rising to about 100 feet above the water, and after cevering a circultous route, seturining and alighting at the very spot from which he started, with his mobiles in perfect control.

These of us who believe that among the uses of the ascryptane will be that of passenger transportation, will find encouragement in the flight of Rager floorance, the French written, who mountly feet, with its passengers, from Dourd to Baleitly and return, covering a distance of districts shell and excentist, that there is a second to the started of the configuration of the configur

d in 1863 be

Sir James Dewar, F.R.S.

Famous for His Researches in Low Temperature Phenomena

By P. F. Mottelay

THE JAMES DEWAR was born at Kincardine-on-Forth, Scotland, on the 20th of September, 1842, gheelyed his education at Dollar Academy and Edin-burgh University, and when twenty-nine years of age married to Helen Rose, daughter of William Banks, Edinburgh

en appointed assistant to Sir Lyon

Figral, then professor of chemistry at Edinburgh University, from whom he received the principal part and the chemical training, and in 1888 spent the sum-simp at the University of Ghent under the celefirm at the University of Ghent under the cele-brated professor Friedrich August Kekulé, continuing a recearch started at Edinburgh on the oxidation of the contact bases, from which originated the Dewar-Körner theory of the pyridine ring. He is the author of numerous papers covering an unusually wide range of chemical and physical subjects, and is now entitled, id chemical and physical subjects, and is now entitled, agong other claims, to the distinction of being the recognised world authority on the constitution the atmosphere. In 1875 he was appointed Jacksonian Fredessor of Natural Experimental Philosophy in the Cultiversity of Cumbridge, and he has occupied since 1877 the highly coveted past of Fullerian Profess.

sor of Chemistry in the Royal Institution. He has besides been lecturer on chemistry at the Dick Veterinary College, chemist to the Highland and Agricultural Society, as well as examiner in the universities of Edinburgh and London, and is at present director of the Davy-Faraday Research Labor

The field of work with which Dewar's name is perhaps more closely linked than any other is that of low temperature ssearch. During the year 1891, on the orcasion of the celebration of the centenary of Faraday's birth, he proved among other teresting lecture at the Royal Institution, that oxygen, which is known to be but feebly magnetic at ordinary temperatures, becomes highly susceptible to magnetism when sub-jected to minus 180 deg. tured notably on the on the "Chemical Actions of Liquid Oxygen," and on the "Production of Oxyin the Solid State, these papers were rapidly followed by others,

raphaly followed by others, among which should be singled out those on the "Spectrum of Liquid Oxygen," on "Liquid Atmos-pheric Air." on Liquid Nitrogen," on the "Electrical Resistance and Thermo-Electric Powers of Pure Metals, &lloys, and Non-Metals at the Boiling Point of Oxygen and of Liquid Air," on "Electric and Magnetic Researches at Low Temperatures," and on magnetic researches at Low Temperatures," and on the "Properties of Liquid Fluorine." In the produc-tion of the leastmentioned liquid he worked in con-junction with Prof. H. Moissen.

It was for his investigations of the properties of matter at lowest temperatures that the Rumford medal was presented to him in 1894 by the Royal Society, whose president at the time remarked that Prof. Dewar had disphased throughout his researches not only marvelous skill and fertility of resource, but Pear. Dewar had displayed tursuspour and only marrieleous skill and fertility of resource, but also great personal courage, and that he had not also succeeded in preparing large quantities of liquid desgas, but that he had, by his device of vacuum-substated vessels, been able to store the liquid under simulation of the personal courage large intervals, and thus to give it as a cooling tested. During his last Friday simulation of the light season, first Pames Dewar amplifund here, with the aid at chargon, he had been like in make these causum-lackated weamle out of light, spetchs, like coppes, neight, brant, etc., intered of the thirties gives hithers associated. known that without these peculiar vessels (called Dewar fissks by the scientific world) the crowning achievement of obtaining hydrogen in the liquid state scarcely have been possible.

In his presidential address to the British Association at Belfast in 1902, Prof. Dewar makes the follow-ing reference to the liquefaction of hydrogen, next to helium, the most elusive of all gases: "Compared with helium, the most elusive of all gases: "Compared with an equal volume of liquid air, it requires only one-fifth the quantity of heat for vaporization; on the other hand, its apecific heat; is ten times that of liquid air or five times that of water. It is by far the lightest liquid known, its density being only one-quarter that of water. It is by far the coldest r that of water. . . It is by far the course by farm . . . Reduction of the pressure by farmarature to minus liquid known. . . . Reduction of the pressure by an air pump brings down the temperature to minus 258 deg., when the liquid becomes a solid resembling frozen foam, and this by further exhaustion is cooled to minus 260 deg., or 13 deg. absolute, which is the lowest steady temperature that has ever been reached At this nadir of temperature, air becomes a rigid inert solid. Such cold involves the solidification of

losing the entire two years' accumulation through the collapse of the glass vacuum vessel containing the regenerator coil, he had to begin all his experiments Notwithstanding this, his researches, though as yet necessarily incomplete, were such as to justify him in predicting the probable properties of liquid helium of these, the most important was that the liquid den-Of these, the most important was that the liquid density would be found about of 14, or at least twice that of liquid hydrogen. Since then this prediction has been closely verified by Prof Kamerlingh Onnes of Levden, who has found 0 15 as the experimental value SIF William Ramany and Mr. M. W. Travers had inferred with less truth that the liquid density of helium would be 0.43. The critical pressure and generated the contract of the contract helium would be 043. The critical pressure and gen-eral order of constants were what Sir James Dewar suggested, the boiling point being 4 deg absolute, and the critical point not more than 5 deg. on the absolute scale. The results of direct observations made by Prof. Onnes were Boiling point, 4½ deg.; critical temperature, 5½ deg C absolute; critical pressure, 2½ atmospheres. ressure, 2½ atmospheres. One of Dewar's most important discoveries in

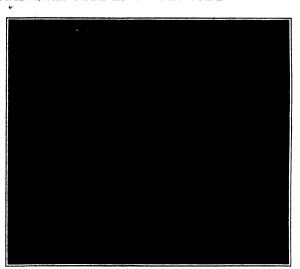
other fields was that of cordite, made in conjunc-tion with Sir Frederick Abel, who also aided him in developing other ex-plosives accepted by the plosives accepted by English government military purposes Mention should be made of the fact that he was first to study the very important oxida-tion products of the quinoline bases, and that much of his attention has like wise been given to the interesting study of phos-

In the accompanying photograph Sir James Dewar is shown holding in his hands a bulb of the type associated with his name He is of middle height and well built His strong, clear-cut, refined eatures and deep-set eyes give him an impressive appearance Whether seen at the experimental table, on the speaker's platform, or in his magnificent quar-ters at the Royal Instituters at the Royal Institu-tion, the impression he conveys is one of great earnestness, happily com-bining the thoughtfulness of the born scientist with the dignity and refinement attaching to his prominent associations and very ings A strongly indi-

vidual stamp is given to these latter by a wealth of the very rarest pictures, engravings. Henvenuto carvings, tapesties, acares books bound in the most sumptuous fashion, etc., which he and Lady Dewar have collected in the

ourse of their travels.
Sir James Dewar's delivery in public is most excellent, and a certain charm is added to his well-modu-lated voice by a touch of the Scotch accent which he still retains. The preparation of his lectures and reports shows great care and precise method. Indeed, were it not for this, and his propensity for a happy co-ordination of facts, figures, and deductions, the forceful, logical, convincing presentation with which he always appears to impress his heavers, would be impossible. As can be easily realized, it is not an easy task, when treating of the very abstruce subjects he has dealt with, to adapt to the comprehension the masses the results of explorations made in hitherto unknown paths such as we have called to

His success has been so marked so extraordinary, of such benefit to mankind, that we must all wish many more days may be spared him to enhance, as he surely will, the admirable work he has already accomplished, leading him to disclose many more of the valuable secrets that Nature guards so



Photograph by E. O. Hoppé,

Sir James Dewar, F.R.S.

every gaseous substance but one (helium) that is at proach the zero point of absolute temperature, we seem to be nearing what I can only call the death of matter. . . . Its existence has long been indicated by the regularly diminishing volumes of gases and the gradual falling off in the resistance offered by pure metals to the passage through them of electricity is der increasing degrees of cold. . . . The liquef The liquefacder increasing degrees of cold. The liquefac-tion of oxygen and air was achieved through the use of liquid ethylene as a cooling agent, which enabled a temperature of misus 140 deg. to be maintained by its steady evaporation is eaces Liquid oxygen is markedly waspetic, comparing with iron in this respect in about the ratio of 1 to 1,000 . It is a non-conductor of electricity, and an induction coil which would give a long spark in the air, failed to pierce a

would give a long spark in the air, failed to pierce a layer of liquid caygen one-chard of a millimeter thick."

The remarks made at the Befrast meeting would now, of course, have to be modified by reason of the progress slapes made with helium, as shown in Bir James's papers (1997). "Studies in High Vacua and Helium at Low Temperatures" and (1909) "Problems of Helium and Zadium." In the first-named, he incidentally explained the very slow process of obtaining belium from gas given off by the King's Well at Bath, and alluded to the fact that, in consequence of

The First Flight from Shore to Ship

How Ely Flew from Selfridge Field Across Country and Landed on the U.S.S. "Pennsylvania"

Ely made the first attempt to fly irom shore to a warship and alight thereon on the 18th inst. The photo-graphs reproduced herewith show Ely's Curtiss biplane just as it was about to alight upon the special platform and also night upon the special partorm and him-after it had alighted and was being brought to rest by a score of ropes stretched across the platform above the two rails which ran its entire length These ropes were attached to sand bugs at each end, and they were found to act as an efficient brake in checking the entum of the machine. Although Ely had floats fitted beneath the lower plane on each side of the center section. plane on each side of the center section, this proved to be an unnecessary pre-caution. He made the flight to the "Pennsylvania," which was anchored amid the dense shipping in San Fran cisco Bay, in 13 minutes, and arrived upon the warship at three minutes before 11 A. M. In flying the 12 miles from Selfridge field, he had risen to a height of 2,000 feet and passed over the San Bruno mountains. Soon after the start Ely was espied by the sailors in the fighting tops of the warship, a tiny speck bove the mountains. The speck grew larger as it rapidly approached and the surfaces of the biplane were outlined against the sky. As it neared the harbor Ely's air craft descended rapidly until, when he flew over the "West Vir-ginia" and the other smaller vessels, he was only 150 to 200 feet in the air. just the right moment he shut off his motor and glided down to the platform on the stern of the "Pennsylvania" He struck this 32×127 -foot platform 25 feet from its outer end, which sloped down-ward 4 feet in 10

After a reception on shipboard lasting an hour, Ely started from the vessel without any difficulty and flew back to

the aviation field again in 13 minutes.

Thus was accomplished the first round trip flight from shore to ship. Ely had Hampton Roads last November. In both instances he won a prize of \$500 offered by the U. S. Aeronautical Reserve. His excellent flights have increased interest in the aeroplane for naval use and will no doubt help in getting through Congress the appropriation of \$25,000 recently asked for by Secretary of the Navy Meyer for experiments in aviation.

The success of Glenn Curtiss in rising from the surface of the water in his ne mounted on floats at San Diego on the 26th of January, will also help along the cause of aviation in the Navy.

Recent Fatal Accidents with Monoplanes

M OST remarkable is the photograph reproduced on this page of an Antolisate monoplane diving to the ground with its wings breaking off in midair. This accident, which cost two lives, occurred on December 28th, at Issy-les-Moulineux, just as Laffont, the chief pilot of the Antoinette firm, was about to start for Brussicis with Senor Pola, a young Spaniard, who accompanied him as pas senger. There was a treacherous wind blowing at the time, but this was not sufficiently strong to prevent a flight with an Antoinette monoplane, which is noted for its ability to fly in the heaviest winds Almost from the start, however, the aviator had difficulty in negotiating the severe and irregular gusts, while the the trouble in which he found bimself lie made three circuits of the field be fore crossing the starting line, and he had just started on his fourth circuit when his monoplane seemed to be caught in an aerial maelatrom. It heeled over, plunged and reared, and then dove to within 100 feet of the ground. Just when



The fatal dive of Laffont's Autoin





one wing broke away molished and the aviator and his panion instantly killed. As in the cases of Wack

latter on a Bieriot) a wing broke at end of a swift descent. Apparer sudden strain brought upon the guys when a long swift de guys when a long swift descent we dealy checked, taxed these to the ing peint. After Wachter's seeled the Rheims meet last summent makers of the Antoinette mone strengthened the steel-rod guys added an extra one, but these guys had the weak point of being in two parts, the ends of which were threaded and connected by a turnbuckle. The threaded part of the rods was naturally much weaker than the remainder, which had a diameter of from 1/4 to % inch, and in all probability the threads stripped and the guys broke under the strains to which they were submitted.

Another aviator who lost his life on December 28th in an accident with a Bieriot monoplane was the Italian Picolo. His accident, which is said to have due to the motor stopping when fiying in a strong wind, resulted in a bad smash and such severe injuries to Picolo that he died the next day.

Lieut. Caumont, one of the best French military aviators, also lost his life in testing a Nieuport monoplane on Decem-ber 30th. Before ascending Lieut. Caumont complained that the control le id not work easily enough, but being assured by the constructor that they were all right, he took his chances and made a good flight of about 10 minutes duraa good night or about 10 minutes dura-tion. Finally something jammed in connection with the controls; the ma-chine tipped to an alarming degree and alld sideways to the ground. The or-fleer had both legs broken and was so badly injured internally that he died in a few hours.

Finally, on the last day of the old year, our best and most fearless aviator -John B Moisant-was pitched head long from his Bieriot while descending song from his Heriot while descending near New Orleans. Mr. Elmer A. Sperry, an eminent electrical engineer of New York city, has put forth the theory that Moisant's accident was caused by gyroscopic force, which so suddenly titted his machine from the sharp angle of about 60 degrees at which it was descending to one of 90 degrees or more, that the aviator was taken un-cwares and shot out of his monoplane with great force. Mr. Sperry points out that, supposing the propeller to have a weight of about 35 pounds and to be revolving at 1,000 revolutions per to volving at 1,000 revolutions per minute, and also taking into account the re-volving optinders of the Gnome motor, it was only necessary that there be a pressure of 48 pounds more against the front of one of the wings at a distance of 8 feet from the body of the moneof a feet from the body of the mone-plane, than against the other, in order to produce a strong gyroscopic force of 1,654 pound-feet that would tend to turn the machine forward through an arc of 130 degrees in a second. Such a slight difference in pressure against the wings could easily be set up by a night move-ment of the vertical rudger or, by the machine striking one of the so-called "air-holes" that are said to be so a numer-Mr. Sperry believes that the



The Administration Building.

NINE years ago Mr. Andrew Carnegie founded the Carnegie Institution at Washington, a scientific Mrean without a parallel in the world. A few weeks ago he added ten million dollars to the original ten million great and to the first million from since that is a larger aum than most of us can conceive. An endowment of twenty-five million dollars means an income to the institution of \$2.37½ for every minute of the year, day and night, Sundays and holidays included. And all for Science!

There are two types of mind that marvel at this wast sum, and then wonder that good money should be spent apparently so recklessly. Two types of peopue there are who do not quite see the use of it. There are those who are oppressed by the consciousness of so much suffering of all kinds that is in crying need of relief, those who see poverty and sickness and the mental misery that folious in their train, the distress that is caused by moral sickness too, and who know how hard it is to abate a fraction of it all without the means; those who see in a large, round sum of money great possibilities in the way of food and fuel and shoes and medicines and comforts and sum of money great possibilities in the way of tood and fuel and shoes and medicines and comforts and and the three are those who fastier themselves that they are "practical" and have no meed for theory, those to whom theory means just the impracticable and the ineffectual. To both of these classes science means a certain intellectual

luxuriousness, something very nice if we can afford it, but not to be considered as long as there are "real" needs pressing for solution.

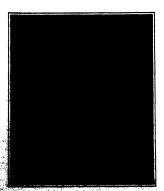
THE PRACTICAL GOOD TO BE DERIVED.

Without denying the existence of dire distress that is harps measure susceptible to rules with the aid of ample funds, and without minimizing the importance of producing "practicals" results, the endowment of secteme may be justified even to the bleeding heart and the busy hand. Modern moclety has passed so rapidly from the state of individual and hand production to the state of factory and machine production, that some of us have not had time to adjust ourselves to the new modes of life and of labor, and to tentourselves away from the traditional modes of thought that went with the old forms of production. The mode of life characteristic of the present is the urban mode. The mode of work that is characteristic of the present is the arbon with technical direction and correlation. The mode of thought that is characteristic of the present is the scientific mode.

scientific mode.

Now city life implies conditions of communication, of transportation, of transit, of housing, and of sanitation that are vastly more complex than the generation of our civil war veterans ever dreamt of. The method of the factory implies a comprehensive development of the technology of production which is a

tremendous advance over what was even thinkable two generations ago. And the technology of our urban mode of life and the technology of our modern mode of producing raw materials as well as finished articles rest upon a foundation of knowledge—scientific knowledge, knowledge that has been slowly acquired through the systematic efforts of the investigator. "Technology," it has been well said, "is a byproduct of science." And that is strictly true. Occasionally a man hits upon a useful combination of materials by accident; in some occupations the rule of thumb still obtains. But the great body of our technical knowledge, the great body of these complex operations that distinguish human action of to-day from that of all past times, has resulted from a deliberate application of scientific principles worked out in the laboratory or the field. The method of hitandmiss must give way to the method of certain knowledge, not merely because we are competing with other nations in the "markets of the world," and must perforce eliminate from our industries waste and insdictors. The sarrneed would exist townorrow if by some means we were completely withdrawn from seconnic competition. The hitand-miss method are eliminated only as its becoming every graphly conscious of the value and possibilities of human living, and is becoming accordingly resentful of everything that is wasteful of human life and human effort. And the hitand-miss method can be eliminated only as fast as we

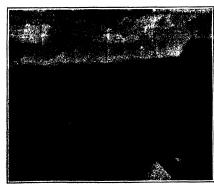


The Original reductive believes of the



the "Cornegie," a non-

The second secon



First section of the 150-feat tower telescope of Mount Wilson.

have scientific knowledge to take its place. If there are diseases to conquer, we shall conquer them when our knowledge of the intimate behavior of problems, in its marvelously varied manifestations, has reached a certain stage. If we are not yet able to reaso on our cultivated acres sufficient wheat and wool and corn and beef to feed the hungry and clother naked, we shall be able to do so when we know enough about chromosomes and blotypes and other things with queer-nounding names! If we are aware of the danger of a rapidly diminishing fuel supply, we shall be set at ease by studies of sun-spet and wave-motion and other "theoretical" problems. If we may not get relief of a permanent kind by distributing the millions of the millions of the millions from some likely to find a way out by getting first the products of some year laboratory or of some wast investigation in anthropometry, or other "impractical" studies.

It is very significant that the earlier endowments of scientific research were confined to assisting It is not to be supposed that all the men whose generosity prompted these gifts were so calculating as to select the physical sciences for spebecause of their more direct applicability Man like Thompson and Tyndali at any to industry to manuscry man like Innonposit and valued research "for its own sake," as the saying is, however it may have been with men like Smithson or Franklin. The ment of astronomical research appeared very early in this country, when the question of economic returns were entirely out of the question. But astronomy as an object of university study had a traditional claim upon those who were inclined to give material aid to higher education; and the physical sciences established their claim simply by producing results. resting thing about these more recent endowments is the fact that biological and social sciences getting for the first time an opportunity to receive a free development with the aid of large funds And if this period of biological research shall be found in later ages to coincide with a large development of man's mastery of the living forces of nature, it will not be because Mr Carnegie had a shrewd suspicion that the facts about the "Induction of Fasciations" or about "Fossil Cycads" could be turned to account in increasing the wealth of the nation But Mr Carnegie and Mr. Roskeleller and Mr. Phipps and Mr. Crocket and many others who have shown more skill in the arts of commerce and finance than in the arts of the laboratory or of the observatory, have come to believe that somehow or other scientific research is worth what it costs—though the cost is high. In a way we have now reached a point at which science seems to be a by-product of finance or industry; but in reality this is only a loan, and it will be repaid a hundred-

We must all come to realize that for modern society science is a vital necessity For advancing science there are needed two factors free men and special facilities in the way of equipment. Heretofore of our science research has been carried on in univer-The constant demands that the universities have been making for more and ever more money were made because of the great expense of research rather than because of the expense of teaching The rapid increase in the endowments for scientific research as well as in the number of institutions devoted especially or exclusively to research has raised the question of whether the universities should not entirely divorced from this function and left free to devote themselves to teaching. On the one hand is the fact of increased efficiency to be obtained from specialization and concentration of effort. On other hand are the needs of the universities for On the who can teach from direct and intimate contact with the living stream of new knowledge in the process of manufacture, so to speak. There can hardly be any question that science teaching is most effective in the hands of men who are interested in research, other things being equal. But not only in the interuniversities, but also in the interthe advancement of science, it is desirable that re-search be not banished from the teaching institutions. In the first place, it takes an investigator to recognize the special ability for this special work; and we must depend upon the universities to find our scientists for us If the university men devote themselves to teaching exclusively, they will not find these potential scientists for us. In the second place, the scientist himself needs, at least occasionally, the inspiration and stimulus that comes only from contact with younger minds. While it is desirable to free the man who has the rare gift of discovering the light as far as possible from the drudgery and routing cted with most teaching positions, it is not desir able to separate him entirely from the "stream of youth" or to free him from the necessity of analyzing his own work sufficiently to be able to give to the students an instilligities account of what he is doing. There is still another point at which the specialized institution may carry danger. In the universities the investigate has been for the most part free to take his own gait and follow his own inspiration. This indeed is the criticism made against university administration in the latest bulletin of the Carnesie Foundation for the Advancement of Teaching (which has no connection whatever with the other institution; for Mr. Carnesie does not let his right hand know what the left hand is doing) In the special institution the worker may be limited by the plans of the administration and the necessity for making a report on a fixed date. We need to guard against wastefulness and inefficiency; but the mind of the investigator may balk at a programme, and that is

wasteful too.
Finally this thought occurs to me: Science is a necessity of life for society. To produce it we need men of special ability and certain opportunities. To get it, we depend upon the generacity of wealthy men coinciding with their wisdom to recognise the desirability of subsidizing other men who have the ability to do the work. In the case of other needs of which society has become conscious, we have simply bought our own supplies. We do not wait for the generacity of wealthy men to clean our streets or to take our census or to carry our mails. But that may simply mean that we have not grown in social consciousness as repidly in one direction as we have in some others.

THE ORGANIZATION OF THE INSTITUTION.

The administration of the institution is in the hands of a Board of Trustees, who sleet a president by hallot. The latter holds his office during the pleasure of the Board, and is the chief arcentive of the institution. The details of management are entrusted to an executive committee and a finance committee, who have control of the distribution of funds to defray current excesses and for endowment of individual research.

The plan which has been adopted by the Institutions in to establish centers in different parts of the States, each according to the locality best adapted for the particular line of work taken in view. The number of suchches is centers, and the variety of work carried on by themselves, when the present time, very considerable and will no doubt be further increased in the future. To give some judes of the nature and scope of the worker of the worker only very briefly pick out a few of the nature.

The Department of Botanical Research is located at Tucson, Artsona, and is under the guidance of Dr. Dr. McDougal The object of this choice of location was to secure as far as possible the simplest conditions of plant life, such as they are presented in a comparatively desert climate. Among the subjects investigated we find such topics as The Climatology of American Deserts; Evaporation and Boll Moisture; Conditions of Farsstifam; Acclimitization; Root Habits of Desert Plants; etc.

Following the order of arrangement of the Year Book of 1910 issued by the Institution, we may not mention some of the work of the Department of Economies and Sociology. This Department is headed by Prof. Henry W. Farman, of Yale University. Among the monographs published from this center within the past are a number dealing with such matters as The Chinese Inunigration; The German Element in the United States; various topics Relating to Agriculture and Forestry; the Mining of the Preclous Medals; Mannature, The Chinesette, The Thompson Table 1910 in the Preclous Control Proceedings of the Preclous Medals; Mannature, The Mining of the Preclous Medals; Mannature, The Chinese of publics of this kind will be obvious even to those whose calling in 11fe is most remote from the fields of pure science.

most remote from the fields of pure science.

At Cold Spring Flarbor, Long Island, is attuated a Department which perhaps represents one of the most modern phases in Experimental Science, the Department of Experimental Evolution. The character of two features 'While it is true that from the very start, in Darwin's own work, experimental methods took a prominent position, yet for many years past, and until very recently, the study, of evolution was based rather on the observation of existing material, than on any gittengt to modify by experiment in addition and predetermined manner scienced examples of biological material. The extension of spich experimental methods took in the confidence of the confidence

Located in a suburt of Washington in the Geo-

physical Laboratory under the discretion of De lawre L. Day, Las the name injulies the 'Enables' Al-Department is to investigate' the shyrical involved in the sensets and past and present of the certifa crust. The week here he great deal of preliminary investigation of physical character, such as the establishment of the physical character, such as the establishment of the certification of the certificati

inated.
It is impossible to describe in detail, within compass of such a short review as our present process of such a short review as our present process. The such as the su

The Chemistry and Physics of Nutrition form the subject of study at the Nutrition Laboratory at Boston, Mass., whose director is Francis G. benedict. The work has consisted largely in the study of metabolism

in man under various conditions of beath and disease.

The last Department which we shall mention is one, the basis of operation of which cannot be said to be located at any one place, inasmuch as many of the observations are made on board of a special isselling vessel which has been christened after the founder of the University, the "Carnegie," and which is specially designed free from magnetic effects, to serve as the laboratory in which are being collected the data required for a general magnetic survey. This work is under the care of Dr. L. A. Basur.

One can hardly form too sanguine estimate of the possibilities of benefits to be derived by our generation and those who come after us from the systematic endowment of scientific research. At the present day probably no thoughtful man is disposed to question the value of science to the community, so long as merely general principles are mentioned. It is only when some specific problem is referred to that we hear the impatient question, "What is the use of such work?" The man who asks such a question usually forgetful of the fact that he has in his own mind admitted the truth of the general principle utility and is merely unable in this particular instance to follow out for himself the complicated network of threads by which some one particular problem is linked ena, the prop with the infinity of natural phenor standing of which is so essential for our mastery over nature, and for our very life.

The Mail-handling System at the New Pennsylvania Railroad Station, New York City By Joseph B. Baber

ON Saturday, November 27th, 1910, the Pennsylvania Railroad in New York city, which had been operating parity set Hudson River ferries and parity by electric tunnel trains running through the trin Hudson River and East River tubes to ta new station in Manhattan, took up the full service at the new terminal. This change required the inaspuration of a special post office of adequate size and seutement, and a new building 876 feet square, designed by the architects of the station (McKin, Mead & Witke) is being erected by the government on a site west of the station on Righth Avenue and extending from Sizt to Sird Sirved and phout half way from Bighth to Ninth Avenue. Both buildings everarch the out that extends between the tunnel openings, and the handling of arriving and departing small psi-the tunnel treates, far below the street iteryl, hap 't-quired the installation of an ingenious and slaborator mechanicals; system.

meanization system.

A private street runs sions the work side of the Peat.

A private street runs sions the work side of the Peat.

Office huliding, giving epitemne brong list said lived.

Breads to the partly semplested weapiers portion of the

building. This humporary structure, which is now in
consideration with the new veriform disting, at the

sizes of with an inter-covarue drivwary 200 test lung

and 12 feat wide and a madding door love design the colors

the given, level, 200, deal lang test 10, 100; wide, top.

args trucking plass, and offices for so of postal supplyses. Between the state platforms on the track level with ample agaso for a complete constant of the state of the state

be delivered to trains on the so, and incoming mail received vio co-truck subway running for a discipling of the sear and vest along the system is sent down to the basement and sand to the subway by apiral chuice or swoons. A large number of motor the subway by apiral chuice or swoons. A large number of motor subway and subway to a subway to subway the subway

es, however, although ample for the ala good sized modern railroad station, matrive at and depart from this vast term ary per cent of the entire weight of Manual of the Pennsylvania manney, 1 24 25,000 to 15,000 pouches weighing from a all must be handled with extraordinary de connection with trains moving quickly in in the problem was presented of devising a state which must be not only thoroughly reliand of ample capacity for the work, and so de ed as to fit into an underground space cramped the nature of things by the building stru t, but must also be free from all possibility of elay to train movements or interfering of sight on signals. In other words, the task was walk a complex machine for executing one of the ary functions of a ratiroad station—mail handling ste underground space that had already been ad to the lowest practicable amount by the un to the lowest practicable amount by the militable plans of the architects of this unique buildis problem, in which the Post Office Depart ment was so vitally interested, was intrusted to a me-chanical engineer who had already demonstrated special ability and resourcefulness in government work the Treasury Department, Mr. Woodwell, of the Brm of L. B. Marks & J E. Woodwell, consulting enrs, New York city. His solution, a most remarkshe one in departing almost entirely from conven-tional methods, by reason of the inflexible restric-tion above referred to, has proved a success in the uninterrupted facility with which the mails have been handled from the start The electric-motor operated apparatus for handling the outgoing mail was put into motion coincidentally with the opening of the new railroad station, and worked without a hitch, thus demonstrating on the first test the capacity, speed and smooth working of the machinery. To the writer the achievement seemed so clearly an expression of an individuality—that of an engineer of the modern type -that information in regard to the work was sough in a personal interview with Mr Woodwell, and the methods and devices employed were made clear by the following explanation of the system as a whole divided into two distinct parts for handling outgoing coming mail respectively. The theater of actio is in the lower part of the Post Office building and is set on three main stages, viz., at the surface and at two different underground levels. These are the street level, with the mailing floor about two feet above it; the basement fitted up as a Post Office, and duplicating the interior equipment of a group of standard B. P. O. cars, and the track level, on which the mail cars stand on their six tracks adjacent to the four separate platforms.

The outgoin mail, constituting 80 per cent of the total tonage, is handled by an claborate equipment for vertical and horizontal transportation of the southest. Spiral gravity chutes are provided to serve each of the track platforms. The chutes terminating at the two "island platforms" (Nos. 13 and 19) are deather spiral, commencing at the basement and extending downward to the level of a system of election motor operated belt conveyors installed at a 2-bits midway between the basement and the platform. All this point cash out the fact of the conveyor helfs, one of which runs eastward and file of the conveyor helfs, one of which runs eastward and file of the water of the conveyor helfs, one of which runs eastward and file of the water of the conveyor helfs, one of which runs eastward and file of the water of the conveyor helfs, one of which runs eastward on the file of the water of the conveyor helfs, one of which runs eastward and file of the water of the conveyor helfs, one of which runs eastward and file of the water of the conveyor helfs, one of which runs eastward and file of the conveyor helfs, one of which runs eastward and file of the conveyor helfs, one of which runs eastward and file of the conveyor helfs, one of which runs eastward and file of the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the conveyor helfs, one of which runs eastward and the co

ing to the west belt, are carried along on the latter until they reach the tripper mechanism, consisting of a set of idler pullers through which the conveyor built runs and which may be placed at any point on the travel of the belt by the car man handling the loading The tripper is mounted on a carriage made self-propelling by an electric motor with gearing, clutches, and control levers and pedals, so that it may readily be brought to a point opposite the door of the mail car. One of the idlers is so arranged above the mail car. One of the idlers is so arranged above the mail car. One of the idlers is so arranged above the mail car. One of the idlers is so arranged above the mail car. One of the idlers is so arranged above the mail car. One of the idlers and that a pouch traveling along on the belt on reaching the idler is caused to ride up over the idler and on to a deflecting suide and so into a delivery spout attached to the tripper. The motor-propelled tripper and the inserting of its spout into the door of the car, when this is done the stream of pouches pours in at the door of the car, there to be stowed away by the car man. Two of the plat forms are curved, which necessitated the installation of two conveyor belts in series for each of these platforms, with a special device for transferring the nouches from one belt to the other

By using both compartments of this double chute, delivering to the east and west belts at once, four cars can be loaded simultaneously on the two tracks bounding this platform (No 13). The trippers are shifted along from car to car upon signals between the chute entrance on the upper level and the car man. Should the conveyers be out of service, the pouches emerging from the chute compartments can be delivered direct to the platform and handled from that point by hand trucks.

There are four systems of these spiral chutes in The north chute has three entrance openin the mailing floor, one leading to the basement and the having openings in the basement also going to the track level, where they deliver on the and west conveyer belts installed over platform The south chute is a quadruple one leading to platform 4 and having the same layout as the north chute just referred to, but having in addition a compartment leading from the mailing floor direct to the trucking subway. In the design of the spiral chutes, on account of the restrictions of head room and structural conditions, it was necessary to make numerous offsets of straight and curved slides and to employ changes in pitch of the spiral, buffle plates, and verse curves; the solution of the problem being rendered more difficult by the wide variation of the load, ranging from the small, nearly empty canvas pouch to a 300-pound bag filled with periodicals Experiment has shown that the time of arrival of a single letter and of a 300-pound pouch at the bottom of the chutes ely the same.

The several direct chutes installed in addition to the spiral chutes are of parabolic form, securing the maximum speed of descent of the pouches, yet delivering the latter with the minimum of velocity at arrival.

For the conveyor belts, about half a mile of the best rubber belting—five-pli; carvas of long-fiber cotton impregnated and covered with rubber on both sides—is used. The use of ball-bearing rollers to support the belts minimizes wear, and eliminates all "field repairs" by enabling all wearing parts to be replaced without delay by duplicate interchangeable parts.

Four plunger elevators, operating between the different levels, can be used for lowering outgoing mail in emergencies, but their regular use is for lowering pouches of registered mail and for lifting incoming

For handling the incoming mail, one of the track platforms (No. 4) has an underground conveyertwo belts leading from east and west-delivering to a bucket elevator installed at an intermediate point, "Loading stations" spaced short distances apart are provided, having trap-door openings in the floor, through which the pouches are thrown from arriving mail cars to be received on a moving belt. The design of this co-ordinated conveyer and elevator equip ment was one of the difficult special problems of this handling system. The buckets of the elevator pick up the pouches as they come to it from the belt, and it seary to eliminate all possibility of crushing or injuring a pouch, or deranging the apparatus, at the fer point between belt and elevator. this safe handling each pouch must be transferred e elevator at the right instant for one of the huckets to receive it. This object has been ished, first, by operating the whole conveyer and elevator system from a common electric motor installed at the top of the elevator shaft, and second, by applying a time-interval operation to the receiving of the pouches on the belt itself. When a pouch is thrown into the opening of a loading station it lands, not on the belt directly, but on a shelf above the belt. From this intermediate receptacle the pouch is autostically nucled at the right moment on to the belt running beneath. The time of this deposit on the carrier is controlled by the movement of the distant bucket elevator, through the medium of compressed in in piping connecting with a differential pinton mechanism which moves the pusher back and forth; the buckets as they approach the delivery point of the belt, by operating a compressed air valve included in this piping, cause the pusher to operate at Just the right moment. An interlocking mechanism incorporated with the loading levers of the stations prevents conflict of delivery of ponches from the two parts of the belt. When one belt is working the other is out of operation. The bucket elevator can handle 1,296 hours as hour.

In the annexed pictorial view almost the full activity of the different mechanisms may be traced. The prirate street at the ground level and the common motor for the bucket elevator and underground conveyer appear at the top of the view. Outgoing pouches are Outgoing pouch dumped in the spiral chute leading from the Post Office in the basement to platform 13, and are being loaded in a car on track 22 standing at this plat-The other overhead conveyer over platform 14 well shown In the middle of the view is a is also well shown motor truck standing on platform 14, which is at the door of one of the plunger elevators. At the extreme right is the south spiral chute in operation, and behind the same, incoming mail is being received on the ement level, delivered by the bucket elevator from the belt running under platform 4. The train which brought this mail is standing on track 8 in the background, and underneath may be seen the 22-foot high

Freak Shadows in Oil

By J. Mayne Baltimore

I an the crude oil producing regions in California there are scores of large ponds of this material. After being pumped to the surface, the petroleum is emptied into depressions in the earth, where it remains for time. Later the crude oil is placed in barreis, large metal cans, or elso in big reservoirs. These oil ponds are known as "sump holes"

There is one very peculiar thing about these "sump holes," and that is in the way of producing what are known as "freak shadows. There are real shadows, but, notwithstanding this fact, they are decidedly "freaky." If the sun is brightly shining and a person stands for a few moments on the margin of the "sump hole," so that his shadow falls on the surface of the petroleum, and he then quickly changes his position, the dim shadow remains just where it was originally cast. In other words, the "shadow does not foliow the substance."

This may seem like a paradox, but it is true The instant a person shifts his position his shadow is again cast in a new place, yet the former shadow remains unchanged. The longer a person stands in one particular spot, the longer will the former shadow be visible.

Hundreds of experiments have been made along these lines, and every time the same results have been produced. The simple explanation for this phenomenon is that under the hot sun gas is being constantly generated down in the body of the perroleum, and it rises to the surface in the form of little, minute bubbles. So very small are these bubbles that they are scarcely visible to the naked eye Millions of these weel-bubbles are rising to the top all of the time, when the bubbles break and the gas is liberated, passing into the air

Both the gas and bubbles are so very super-sensitive to the temperature that even one's shadow cast for a moment across them is affected. The temperature is lowered. Whenever the substance quickly changes position the shadow remains until the rays again warm up that spot and the shadowy outline slowly fades away. Of course the "freak-shadow" may be seen for only a very few seconds.

A \$15,000 Prize for Aeroplanes

MR EDWIN GOULD has offered, through the columns of the Scientific American, the sim of \$15,000, which is to be awarded for the construction of a heavier-than-air flying machine, equipped with more than one motor and propeller.

The conditions governing Mr Gould's offer were published in the SCIENTIFIC AMERICAN ISSUE Of November 19th, 1910

Our Weekly List of Patents

THOSE readers of the Scientific Ambrican who may mise the List of Patents granted in the United States, which it has been our custom to publish from week to week in the advertising pages, are referred to the Scientific American Supplement for the recomb

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Car Periodicals at Home and Abroad

The Harvest Moon

NEAR the time of the autumnal equinox, the moon, at her full, rises shortly after sunset for several evenings in succession, which circumstance gives rise to a series of brilliant moonlight nights, and the moon being above the horizon until late in the morning, presents a charming appearance besides prolonging the light which is so beneficial to the husbandman at this season of the year The full moon that occurs nearest to September 22nd has long been known as the 'Harvest Moon' on account of the pedvantages derived from moonlight during the time of harvest in England, and its yearly return is always celebrated as a festival among the peasantry. The circumstance of this moon rising for several nights in succession at nearly the same hour, immediately after sunset, which has given it an importance in the estimation of farmers, is not generally understood by the public, but the true cause has long been known to astronomers and can be very easily explained." exposition of the astronomical conditions which give rise to the phenomenon is given by A. K. Bartlett in Popular Astronomy, from which we are quoting. "It arises from the fact that the ecliptic, or the sun's apparent path through the heavens, is variously in-clined to the horizon at different seasons of the year. The celestial equator is always at the same angle with horizon, and hence equal portions come above the horizon in equal periods of time. If the moon moved celestial equator, she would rise and set directly in the east and west points of the horizon respectively. and she would rise later each night by a nearly con-stant interval But the moon moves in a path which is constantly inclined to the ecliptic at an angle of about 5 deg., though for the present explanation she may be regarded as moving in the ecliptic; and as the ecliptic to the celestial equator at an angle of 23½ deg, the moon, in all parts of her orbit, does not rise at equal intervals on each succeeding night "When the constellation Pisces is in the eastern

horizon the ecliptic rises with the least angle. Now, in September, at the autumnal equinox, the sun being septemeer, at the autumnal squinox, the sun being in the constellation Virgo, the moon at her "full," when opposite to the sun, is in Pisces and rises at sunset On the following night, though the moon has advanced in her orbit about 13 deg., yet her path being very oblique to the horizon, she will be but little below her position at the same time on the preceding night. She rises, therefore, only a little later, and for several evenings appears in the east at nearly the same hour after sunset

"Though the differences in the time of the moon's rising are always great when she is in or near the constellation Virgo, and small when she is in or near Pisces—that is, every month—yet we never notice these variations except in autumn. In fact, we seldon observe the moon's rising at all unless it be when she rises near sunset, or in the very early evening. We usually give more attention to the full moon, and the moon can be full in or near Pisces, where the difference in the time of her rising is least, only when the Sun is in or near Virgo, which cannot occur except in September at the time of the autumnal equinox. In March the conditions are reversed, and the moon at her "full," rises on successive evenings later than at any other time of the year.

"In our latitude, the difference between the hours at which the full moon rises on succeeding evenings in September, amounts, on the average, to rather more than twenty minutes, or about half an hour less than the mean interval, while in March the average differ ence is about 1 hour and 20 minutes, the least possible variation in the time of her rising being 10 minutes, and the greatest 1 hour and 30 minutes. Those parts of the ecliptic which rise with the smallest angle set with the greatest, and those which rise with the greatest set with the least, so that, while in September the full moon rises at nearly the same hour on successive evenings, the time of setting varies considerably, owing to the large angle of the ecliptic with the western horizon The phenomenon of the "harvest moon" is much more striking in Northern Europe and in Can-ada than in the United States, and in very high latiace man in the United States, and in very high lati-tudes the moon, when it has its greatest possible declination, becomes circumpolar for a certain time each month, and remains visible without setting at all tilts the "midnight" sun'y for a greater of less number of days, according to the latitude of the offscryer

"The husbandmen of old believed that the so-called 'harvest moon' was a divine interposition to prolong the day and thus aid them, but science has shown that

on is simply the result of nat The name so devoutly given is, however, still lovingly cherished, and as long as the solar system preserves its present relations, the return of the "harvest moon" each year commemorate the simple faith first observers of this crowning beauty of our Septem-

Modern Development in X-Ray Technique

I T is extremely doubtful if any purely accentific discovery was ever more quickly followed by a worldwide and lasting interest, or put to practical use,





The origi inal Crooke

Fig. 3.—A mor

than Roentgen's discovery of X-rays. An interesting historical review, leading right up to the present state of radiography is given in *Knowledge* by Reginald Morton, M.D. We quote here some of the essential points of Dr. Morton's article.
"The way was paved for Roentgen's work by the

experiments of Crookes with highly exhausted vacuum tubes. He observed that with increasing vacuum there was formed a dark space around the kathode, which increased in extent as the vacuum was in-



Fig. 2.—The X-ray tube as improved by Prof. Herbert Jackson.

creased. Concurrently the glowing gas which at first entirely filled the tube gradually disappeared. He also found at this stage new radiations were given off from the kathode, their direction being at right angles to the surface of emission. These he called kathode rays, and he ascertained from their behavior to a magnet that they carried a negative charge. Owing to their curious properties he was under the impres-sion that he had discovered a fourth state of matter -'matter in radiation'-but he altered this view later



on when he tound that the observe capable of a different explanation. a focus, and by directing them on to such as fluor spar, calcined shells, and we he produced brilliant fluorescence and if the action were prolong served that when the exhaustion was ont an extent that the dark space reaches inner surface of the tube itself, the beautiful green fluorescence, as well as temperature, and that these effects were if the kathode was of concave form and the tube at or near the food point of the kathode was on the least doubt that the X.

produced in these experiments, and the ge well be asked how it came that they were not by Crookes. The answer is very simple visible to our eyes they would easily esc tion in the ordinary way; then we must rest that Crookes confined his studies to what was on inside the tube, and at that time there veridence of any kind to suggest even the pos

of radiations passing through the wall of the a "The publication of his famous paper soon sta many other men experimenting in the same direct and in 1892 Hertz announced that the kathode would penetrate thin metallic sheets if placed in the tube, and within their path. Soon after this He unfortunately died, but his experiments were carrie on by his assistant, Lenard, who in 1894 had a tel made with an aluminium window. This, when excess with an induction coil current, allowed the rays pass outside the tube, and it was observed that would also pass through other opaque bodies, such as paper, giving rise to fluorescence and phosphore in certain substances, and even affecting the se salts of silver in a similar manner to ordinary ligh salts of silver in a similar manner to orunary user. The only mistake made by Lenard in these eposits making experiments was in thinking that all these affects were due to the kathode rays alone.

"In November, 1885, Rounten, while experimenting with a Crookes tube, noticed that a small screen coated with a trouble in altitude and fluorescade brilliantly is

with barium platinocyanide fluoresced brilliantly in the proximity, though the tube was covered with cardboard and no light could be seen issuing from it. Following up this phenomenon he made out that this radiation came from a spot on the Crookes tube corre sponding to the point of impact of the stream of kathode rays. He further ascertained that all substances were transparent to this new form of radia-tion, though in varying degrees, depending on the atomic weight of the elements composing the sub-stance. He also found that the radiation came in stance. He also found that the radiation came in straight lines from the point of their origin, and that they could not be reflected or refracted, and were straight lines from the point of their origin, and that they could not be reflected or refracted, and were not in any way influenced by a magnet. It was now orident to him that he was in the presence of radia-tions hitherto unknown, and he forthwith set about an exhaustive study of their physical properties, so as to determine their exact nature, and so perfectly did he do this, that his original monograph has never been seriously added to up to the present time.

mover been seriously added to up to the present time.
"Having shown how any inequalities in density in
any given object would be registered on a photographic plate, he at once recognized the immer portance of the discovery to surgery, and made his mmunication to the Physico-Medical Society of Würzburg in December, 1895.

To describe in detail the various steps in the de-"To describe in detail the various steps in the development of all the appearatus used in radiology would, and does, fill many a good-sized volume. We may, however, trace the evolution of the more important parts of the modern X-ray outfit without going beyond the space usually allotted to such an

ticle as this.
"In view of the fact that the whole soles radiology centers around the X-ray tube, and that everything else is subsidiary to it, we may very fitty consider this first. The original experiments were made with tubes of the well-known pear' shape orig-inated by Crookes. In these the kathode stream was impinge upon some part of the wall of the tube. (X-rays are produced when a stream of had ode rays are suddenly arrested by impact against solid body.) The area of impact was always large-sometimes the whole of the large end of the tub sometimes the whole of the large and of the tane showed the characteristic green fluorescence, shawing that the X-rays were being given all from its whole area. Under such conditions the insees of a fluor-scenat seven or a photographic piete ways much litured and generally indistinct. The was, at seages A very great disadvantage, and had so other large

he in such to say that the science of himse minde very little progress. The mante dispertant single contribution to and the most important single contribution to undersor was marked by Prof. Herbert Jackson, of gr. Chilege, Landson, the made a tube with a conbethele, and mainted at or near the focal and minimted at or near the focal of the system. The result was that all the same from the smint, and gave sharp shadows have outlines as well as details of minute strucdency is for the vacuum to slowly increase accepted emplanation of this is that the electrons measure management in the waits of the tune, manifest are gate one at addition. It is even believed that nember are divisors single through the glass. A certain number of those sunheded can be restored to the body-of the tutes by beating the glass, and this was make method of segenerating a tube in the earliest The need of the need for regeneration was owing that that with the increase of vacuum the tube are restaurant that the electric current passed that as resistant that the electric current passed the character of the radiation altered, so that a better than a fine called gave very poor images the photographic plate, although the shotographic plate, although the screen apme a ford tube are less active in affecting dittee selfs of silver, and hence it does au-tify felfine-that a tube that gives a satisfac-age of the acreen will give a good account when used for registering the image on a othe to

saitive plate. for regeneration of the vacuum in a convenient or, and each has certain advantages. At the there seems to be an almost universal ag tube makers to employ some porous material such as asbestos, spun glass, leaves of mica, and so on. The material is inclosed in a small access bulb, the cavity of which communicates with tube, and so arranged that who tames of the main tube rises beyond a certain the electric current passes through the small b. heating the porous material and causing it to give of sense of its occluded gas. This passes into the large take, lowers its resistance, and the current re-

we has proper course. We must now turn to the improvem during recent years in the coils and other high poten-tial transformers. Before the days of the X-rays, induction coils were rated or compared with one another according to their spark length. The maker of a big coil aimed at a certain spark length, and was very particular as to how it was obtained; but the curious fact was, that when one of these big coils was used for X-ray work the results obtained were not always those expected, though it was generally agreed that large coils gave better results than small About the beginning of the present century commy coils were in use giving sparks of twenty, thirty or more inches in length; but as it was realized that a spark length of anything up to six or eight inches cient to overcome the resistance of any useful X-ray tube, it became apparent that nothing was to be gained by increasing the sparking distance of the beyond a certain point, which has been found to be about fifteen inches. The only other thing to do was to increase the quantity of current available, and so drive a larger volume of current through the X-ray tube. As is well known, the current from any induction coil is not continuous, nor even unidirec-It is an alternating current, but the wave of one sign preponderate over those of the opposite Owing to the fact that the resistance X-ray tube to an inverse current is less than to a ent in the right direction, it is necessary that e lesser and inverse waves be kept as small as pessible—the reverse current having a very deleteri-

"The first attempts at making these heavy discharge coils, as they were called, were not very suc-caseful; in fact, until very recently, all these colls suffered from giving out too much inverse current, which, as we have seen, is very detrimental to the

st colls are a very great advance on anything of the kind that has been brought out before. Not only are they very economical of primary current for the very heavy secondary discharge they give out. but they are for all practical purposes quite free from inverse impulses.

"The very latest type of induction coil for X-ray work is what is known as the single flash coil." The m of this is such that a radiograph of almost the part of the body can be made with a single interthe state of the second of the and against a spring in compression. The act of turning on the current draws back the catch and the wire rushes up by the action of the spring, and the



Fig. 5. -Radiography of the kidney.

The metal cylinder muon which the X-ray tube is mounted is pressed down into the abdomen reducing its thickness and preventing all

circuit is broken at the moment the wire leaves the "This is the latest development of the induction coil, and in all probability it will have a far-reach-

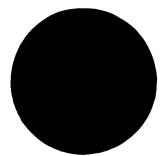


Fig. 6.-A radiograph showing a stone in the kidney.

ing effect on the future of X-ray technique. It is not unlikely that in future we shall be regulating our exposures, not by so many seconds or minutes, but by the number of flashes or interruptions. What is



Fig. 7. -- Teleradiography. The tube is placed two meters from the photographic plate against with a patient stands. The shadow of the heart is but very slightly larger than the heart itself and sufficiently correct for all practical nursures.

now wanted is a means of giving any desired number at will, and, in all probability, this will be achieved before very long.
"Early in the days of radiology it was observed



Fig. 8.—Treetment by the X-rays.

* A Committee of the Co

that the intervention of a diaphragm increased the definition and sharpness of the image, in the same way as in the photographic lens, then it was found that if instead of using a hole in a metallic disk the rays were made to pass through a metal tube a still further gain in sharpness was attained. So important is this, that the use of the tubular diaphragm is essential if the best radiographs are to be secured

"One of the most difficult matters to deal with is that of movement. Some patients have the faculty of keeping still for comparatively long periods of time Very many others have not; the movements may be voluntary, but are frequently involuntary from vousness, or tremors that are not under control All the organs in the thoracic, abdominal, and pelvic cavities move to a greater or lesser extent with the movements of respiration, and this is an important factor in assisting the performance of their normal functions. Some of these movements are easily re-strained, others are not, and many devices have been brought forward for this purpose; but the most generally useful of all is that in which the tubular diaphragm is mounted in a framework that passes across the patient, and is so arranged that it can be lowered down and made to press firmly upon the part it is desired to examine Movement can in most cases be perfectly restrained, and the improvement in the quality of the resulting image is, taken without any disphragm, quite startling One of its greatest uses is in the examination of the kidney for calculus. (See Fig. 5.) This organ under normal conditions moves about half-an-inch with each respira tion, and if this is not restrained no clear image can be secured. With the compressor diaphragm this is easily done, the outline of the kidney is sharply fined, and its size, shape, and position are definitely registered. As might be imagined, the difficulty increases with the stoutness of the subject, but this is not nearly so important as it was, and a good result can be secured in nearly all cases, with a little care and trouble

The use of this device necessitates the X-ray tube being above the patient, and it is not easy to make a preliminary inspection with the fluorescent screen which, in many instances, is all that is required. many have to be examined, as in th patient department of a hospital, it is a great convenience to have a couch with a canvas top upon which the patient is laid. The X-ray tube is fixed in a ray-proof box with an opening at the top through which the rays emerge, and this box can be moved in both directions so as to bring it under any desired The canvas being transparent to the rays, we can, with the aid of the screen, look through the patient and frequently see all that is wrong, if there is any doubt, an X-ray plate is laid on the place and steadied with sandbags while the exposure is made. This is a convenient method for dealing with a numof cases, and the results are good enough for

What the Panama Canal Will Mean in Our Relations with Peru

commenting upon impressions recorded by John M. Turner, a flour and grain expert, the editor of Peru To-Day remarks:

"A great development is in prospect for the West east of South America . . . The effects of this Coast of South America . . . The effects of this will be felt in advance of the completion of the Panama Canal in 1914. While the whole of South America will benefit from this most wonderful of modern undertakings, there is no question in the minds of thinking men that Peru is in a position to realize to the utmost the advantage to be derived from the opening of this great waterway. It is with this in view that the business departments of our great northern neighbor are so active. Let there be no mistake about it The United States of North America may have been slow in waking up to the existence of this market so long neglected, but the awakening has come with the noise of the dredges and the drills working in the 'big ditch,' and the trade map of this continent is about to undergo a radical modification . The Pan-American Railway may be a dream, but the Panama Canal is a reality, and American shipping will follow the commercial representatives, tourists and investors of that country who are our frequent guests. American capital has already developed important indus-tries and built great railways in Peru, and is even now seeking, and finding, new work to do. The United States Department of Commerce and Labor The knows that there are metals, fabrics, and natural products of many kinds in Peru for which they can provide a market, and that in return we need many things which can best be supplied from their factories On the other hand, the Peruvian government, through studying commercial and manufacturing conditions in North America, and is ready to consider and act upon every suggestion which has merit behind it.

A Shadow in Court

By William F. Rigge, S.J., F.R.A.S.

Wille we take it as a matter of course that almost any of the sciences may be called upon to bear testimony in a criminal court, we might be somewhat surprised to hear of an astronomer summoned to testify to the time a certain photograph was taken from the position of a shadow. This ally happened on December 9th, 1910, in Omaha.

F E was arraigned for having with malicious intent placed a suit case containing dynan porch of T D, between the hours of 2 and 3 in the afternoon of Sunday, May 22nd, 1910. against the accused was altogether circumstantial exin one instance, in which a girl 16 years of age testified that she had seen E carrying the suit case shortly before 3 o'clock. Upon investigation, John O. Yelser, the attorney for the defendant, found that the witness, before walking to the D. residence, had attended service at a church a mile away. The minister said that the services had concluded about 3 o'clock, and that the young people had lingered a while about the church and had had their photographs

taken several times before dispersing
In looking at one of the pictures in which the witness figured, the attorney was struck by the rather prominent position of a shadow in it curred to him that he had somewhere read an article in which the date and exact time of a photograph had been found from a shadow. The thought finabed upon "What if the time of this photograph coulproved to be after 3 o'clock, and the testimony of the only eye-witness invalidated!"

Consultation with his friends brought the attorney

to the writer, who soon furnished the desired proof and afterward testified that the photograph in ques-tion had been taken within one minute of 21½ minutes after 3 o'clock. As this threw out the testimony of the only eve-witness, the evidence was purely circumsta and resulted in splitting the jury six

After this introduction the reader will most likely be interested to know the method by means of which a shadow in a photograph may be made to betray the exact time of its taking.

principle was fully explained in the Scientific American of Soptember 24th, 1904 It is briefly this, that in measuring the distance that a shadow is cast down, north or south, and east or west, we can find the sun's place in the sky at the moment, and thence deduce the time of the day and the day of the year For this purpose we make use of astronomical triangle whose vertices are the zenith, the pole, and the sun The side extending from the zenith

to the pole is the complement of the latitude of the place. The side from the pole to the sun is the complement of the sun's declination third side, from the sun to the zenith, is the sun's zenith distance, the complement of its altitude. The augle at the zenith is the sun's azimuth counted from the north. The angle at the pole is the sun's hour angle, the local apparent solar time. The angle at the sup is called the parallactic angle

Of these six parts, three sides and three angles three must be given in order to enable us to compute the rest. In the present instance, the sun's azimuth was known from the ratio of the distances that the shadow was cast eastward and northward The sun's nititude also was known from the ratio of the verti cal ,and horizontal distances. The latitude s longitude were obtained from the city map with ref The latitude and ence to our observatory. And finally the sun's declinstion was known, because the day was given and the hour was about 3 P M

There were thus four out of the six parts of the triangle given, one part more than was needed. As the angles at the pole and at the sun were the only unknowns, each of the four known parts was in turn taken as the third unknown This furnished four ds of solving the problem, in which, along with the time and the parallactic angle, the sun's altitude azimuth, and declination, and the latitude of the place were successively taken as unknowns. The results

> 3 o'clock 21 minutes 12 seconds 2 o'clock 21 minutes 31 seconds 3 o'clock 21 minutes 29 seconds.

3 o'clock 21 minutes 38 seconds

The mean of which was 3 o'clock 21 minutes 26 seconds, and the residuals, or differences from the mean. 14, 5, 3, 7 seconds, the extremes being 21 seconds

The close agreement, of the four meththat no appreciable error had been made in any of them. In the first method the azimuth of the sun had been obtained by assuming the curb line of the street to be correctly in the meridian. The second meth made no use of the azimuth at all. The third meth used no other data than the latitude and longitude of used no other data than the institude and longitude or the place and the measures made upon the building, and found from them the time of the day as well as the day of the year. The error in the computed declination of the sun was about one-fourth of its daily variation at the time, so that there could be no doubt whatever of the day. The date, as far as the shadow was concerned, might also have been July 22nd as well as May 22nd, because on both of these days the sun's declination is the same. being altogether out of the question, the lat was negatived by the immature condition of the foliage wn in the photograph.

In the fourth method the latitude, which had been taken as unknown, differed only 42/8 miles from the truth If the time had been given, the longitude would have been found within about the same

The data used in the problem were that the shadow had fallen 1422 feet down, 13.10 feet eastward, and 3.43 feet northward The horizontal distance was found to be 13.52 by measurement and 13.54 by computation. An error of one-tenth of a foot in the shortest horizontal side would have changed the time I minute 54 seconds. The same error in the altitude would have caused a difference of 1 minute 15 seconds. The omission of the correction for refraction would have produced a difference of 2 or 3 seconds.

A shadow in this picture proved an alibi.

v is seen very prominently to the right and its exact location on the building was an easy millipation of the object that cast the shadow was not less easy. The distance of the shadow may not less easy. The distance of the shadow may not see shadow not on the object was 18.68 feet, in one minute the shadow moved at the time 0.095 foot upward, 0.095 foot to the right, and 0.096 foot in its apparent path. It was the width of a weather-board, 0.87 foot, in disparent path.

The latitude was 41 deg. 6m, 42s. N and the longitude 6h, 23m, 48s. W. The sun was 3 minutes 33 seconds fast, and the time used central time.

In some respects the present problem was much more interesting than the one described on September 24th, 1904, in this journal, by reason of the various solutions it presented and its very practical sunlication

The "Arkansas," Our Latest Battleship

WITH the launching of the "Arkansas" from the yard of the New York Shipbuilding Company, Camden, N J., on January 14th, there was floate the latest and most powerful battleship of the United the latest and most powerful naturemap or two conventions. States may, With a displacement at normal draft of 28,000 tons, she greatly exceeds the next largest ships of our feet, which are the "Florida," now completing in the New York navy yard, and the "Utah," which was built at the same Camden yard. These two vessels displace at normal draft. 21,850 tons, so that the "Arkansas" is over for thousand tons greater, a difference which about equa form the displacement of some of the larger cruisers, such as the "Baltimore" and "Chicago," which twenty-five years ago formed the first addition to our new steel

The "Arkansas" and the "Wyoming," which is being built by William Cramp & Sons of Philadelphia, co Durk by William Cramp a sons or "ninaspiral, so that cattle them to be considered as a national type. Chief among these is the great power of the buttery lead its location in two-gum turrets placed, all of them, on the central longitudinal arts of the ship. This plan originated with our Construction Corps, and was

first embodied in the "Sough Ch gan." Another special females mounting is the placing of the adjacent to each other, while the carried at a sufficient b roof of the adjacent turret,

At the time of its introduction tected to a large amount of its tructors and sea-going the blast from the upper mair of a sarily interfere with the operation of the In order to settle this question, our may Ordnance carried out full-sized ter guns mounted temporarily in the pres and the results proved that the ap feasible.

The grouping of the turren as with their location on the longitudinal ourse the valuable advantages that the sales advantages that the sales advantages that the sales advantages that the sales advantages the sales advantages the sales advantages that the sales advantages that the sales advantages that the sales advantages the sales advantages that the sales advantages the sales a The grouping of the turrets in the tery may be concentrated over a hundrede guns can be fired dead shead and de through a complete are of 270 dags of centerline mounting was adopted at a dis the foreign navies were mounting an the main battery in two turrets, wheed one o the central superstructus which, in broadside engagements, mens out two guns from service. It was consider that time that the ability of these four guns shead and astern more than comes above-named loss of broadside fire. ever, these foreign navies have awang around to the American point of view; and it now looks as though the centerline mounting will become authorization. large ships and armor of the future.

guns of the latest 50-callber pat This fine weapon fires an 667-p projectile with a service velocit about 2,000 feet per see muzzle energy of over 53,000 tons. At the modern fighting ra of 9,000 yards, it can penetrate the heaviest armor affort. The gain has been proved to possess remarkable accuracy; and, with the modern system of fire control from statforms at the top of the new lat work masts, our gunners, even at have found the mark, will be able to hold the gun upon the enemy place well over fifty per cent of the projectiles upon the ship.

The main belt, 11 inches thick at

the top, tapering to 9 inches at the bottom, covers all turrets and m sines for a length of over 400 feet and reaches 6 feet below the norms water line. It tapers to a thick-ness of 5 inches at the ends Above this belt is another, 11 inches thick at the bottom, 9 inches at the top, extending for one full length, 400 feet, of the

main belt. There are two protective decks above the magazines, and elsewhere one protective deck. turrets carry 12 inches of armor on the front, II inches at the back, and 9 inches on the sides, the roof protection being about 4 inches The barbettes, below all turrets, are protected by 11 inches of are Furthermore, in way of the magazines, the kansas" will be protected below the water line by longitudinal bulkheads 1% inches thick.

The "Arkansas" is to be driven by turbine engis 20½ knots speed. The cost bunkers can st at 20% knots speed. The coal bunkers can stow 2,500 tons of coal, and there will be 400 tons of oil z,500 tons or cost, and there will be see tons or est in the double bottom. At a 10-knot speed, the radius of action will be 8,000 miles. The total cost of the "Arkansas," when completed, will be slightly over ten million dollars.

If our readers compare the "Arkansas" with the 'Florida" they will note that there is no break in the line of the upper deck. The "Arkansas" presents a gradually rising freehoard at normal draft, from about 18 feet at the stern to 25 feet at the stem, an arran ment which we think greatly adds to the appearan

An excellent feature is the fine command (height of guns above water line) of the main battery. From when the ships are loaded to their full displacement, seboard of the forecastle deck will be 35 feet 3 hos, spaidships 19 feet 2 imphes, and aft 16 feet 2 inches. The height of the guns above water in the six turrets at full load will be respectively, 28 feet 2 her current at the long will be respectively, to test a facilities, 31 feet 3 inches, and 22 feet 24 inches. While such good command 2 will be possible to the low lowest game in any resolute in which an example.



The 26,000-ton Arhanna, ' banehed January 1911 to be completed May 1912.

The Heavens in February

Our Monthly Astronomical Page

By Henry Norris Russell, Ph.D.

NLY last month we were dising one of those interest-stellar systems in which the mutual eclipses of two stars afford us information which we could get in no other way about their real dimen-sions. In the intervening time a new and very interesting case of the same sort has been de-

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scribed, which deserves some notice here. The star is known as u Herculis—being denoted by a Roman thun a Greek letter because there are so many stars in this large constellation that the Greek alphabet is exhausted, so that the Roman has to be brought in and pretty well used up before all the nakedeye stars are lettered. It has long been known that

the star varies in bright ness, but the true char acter of its variations has only been detected very recently, by co-operation between the Allegheny Observatory, where its spec-trum was investigated by Dr. Baker, and the Har-vard Observatory, where its light was measured by Wendell.

The spectroscopic observations show that the star is a close double, with unequally bright components, revolving about one another in a nearly cir-cular orbit, with a period of 2 days, 1 hour and 13 minutes. The measures of brightness show two unequal minima of about hours duration separated by nearly equal intervals of approximately constant light, repeating them-selves in the period already mentioned

The deeper minimum, when 49 per cent of the star's light is obscured, comes at just the time when, according to spectroscopic data, the fainter star should be in Front of the brighter, and the smaller minimum, with a loss of only 2 per cent of light, corresponds to the eclipse of the

righter one. From these data Pro<u>t</u> Schlesinger of the Alte gheny Observatory draws the following conclusions about the system:

The diameter of either star is 5,100,000 miles, or nearly six times that of our sun The brighter star is 7½ times as massive, but only 1/27 as dense as the sun, while the fainter star, which is 2/5 as bright as the other, is of 2 9/10 times the sun's mass and of only 1/70 of its density. The brighter star gives off 2½ times as much light per square mile as the other does. The orbit of one about the other is inclined 15 degrees to a line drawn toward The distance of the centers of the two stars is 6,300,000 miles, and the nearest portions of the two separated by 1,200,000 miles, or about one-quarter of the diameter of either This distance varies from 900,000 to 1,500,000 miles, as the orbit is not quite propositions are based upon careful study of definite and reliable evidence, and there is at present no other star about whose nature we know so much.

It may be added that the star is very white-of the It may be added that the star is very white-of the so-called Orion type-which is for good reasons sup-posed to be evidence of very high temperature, and that its distance from our system is in all probability very great Prof. Schlesinger shows that, if whe brighter star sends out as much light per square mile as our sun does, its distance from us must be about 200 light-years. If it is brighter per adurer mile than our sun—as seems to the writer extremely probable—

its distance must be still greater, and it is not imits distance must be still greater, and it is not lim-probable that the light by which we now see this re-markable system left it fully five centuries ago. Among the events of the month should be men-tioned the discovery of another new star—this time

in England, by Espin, on December 30th. At the time of discovery it was of the seventh magnitude. Photographs taken at Harvard show that it was in-visible on November 17th, but of the fifth magnitude on November 23rd, so that it had faded considerably on November 33rd, so that it had raded considerably before discovery. It is in the constaltation Lacerta, in R. A 22h. 32m, 11.8a, and Dec. 52 deg. 15 min, 20 sec. north, right in the middle of the Milky Way, and shows the characteristic spectrum of paired bright and

In fact, it is in every way a typical nova, and its appearance, like that of its predecessors, is probably

Night Sky : January and Pehruary.

due to collision between some star, far in the depths of space, and a nebula or cluster of meteoric bodies.

THE HEAVENS. Turning from this faint newco changing constellations, our map shows that the finest region of the visible skies is in the south. Beginning right overhead with Auriga, we find Gemini on the left and Taurus on the right, just below; then the magnificent Orion and the Great Dog-whose other stars are brighter than one would think at first sight, so far does Sirius excel them. Still lower, on the very horison, is Argo, whose brightest star, Canopus—next to Sirius in the whole heavens—can be seen due south and very low down from latitudes south of On a level with Orion, and farther east, is the isolated bright star Procyon, marking the con-stellation of the Little Dog. Our initial shows how little relation there is between the imaginative and the real outlines of the group. Only two other stars the real oftimes of the group. Output we other sains besides. Proving any at all conspicuous. These bear the letters lett and comme, and forth with their far tendence pathors a triangle of very immental sides, much significant the sain of the sai

attended by a very faint contact the very greatest telescopes, one-third the mass of its pris 1/100,000 as much light. To Cancer, with the star cluster is the head of Hydra. In the east the horison, and in the northean well up. The Little Barrier well up. The Little Bear and the head below the horizon—are due as Cassiopela are in the northwest, wi up. The great square of Pegastis Andromeds will soon follow. The which contains Cetus, Eridanus, Pissi very dull, and is enlivened only by Saturn in the last-named constellati THE PLANETS.

Mercury is a morning star all the

elongation : the sun, and easily

and is rapidly \$ the 1st and 7:49 cm th

Mars is morning n Sagittarius, rising et 4:30 A. M. in the mildele of the month. He is still a long way from the carth and relatively faint.

Jupiter is morning star in Libra. On the 3rd he is in quadrature west of the sun, rises about 1 A. M. and is due south at a A W

Saturn is evening star in Aries, setting about 10:45 P. M. on the 15th.

Uranus is morning star in Sagittarius, too near the sun to be easily seen. On the 10th he is in conjunc-tion with Mercury, being five minutes south of the

Neptune is in Gemini, and is well observable if one has a large enough one has a large enough telescope. His position on the 14th is R. A. 7h. 23m. 8s., Declination 31 deg. 28 min. north, and he is moving west and north at the rate of 5.9s. in R. A. and 12 sec. in declination per day.

The moon is in her first quarter at 10 A. M. on the 6th, full at 5 A. M. on the 13th, in her last quarter at 11 P. M. on the 30th, and new at 7 P. M. on the 26th. She is nearest the earth on the 9th, and remotest on the 21st.

In her circuit of the heavens she passes by Saturn on the 5th, Neptune on the 10th, Jupiter on the 28th. She is nearest the earth on the 9th, and Mercury on the 27th, none of the visible conjun-

A Remarkable Concrete Building

A Remarkable Concrete Building in Both ton, for the use of a motor car company, has circular column of the same diameter, in the upper and lower stories and has a long span floor construction permitting a desp terratable well of large diameter in each story. The exterior faces of she walls wer willowed by panels and modifings integrate with the body of the wall. The front wall corresponds with the bride and stone fine of our adjacent, built the bride and stone fine of our adjacent, built the bride and stone fine of our adjacent, builting and has a rather displayed tripoutly of corrules deputs, and carryet plane at 10 miles for the wall of the story of the best, are topy integral of the line. In the latest are topy integral.

THE COLUMN THE PARTY OF THE PAR

Carrespondence

Our Smokeless Cannon Powder

or of the SCHWINE AMERICAN to the Battor of the SCHENTIFO AMERICAN:
In six article in the current number of the SCHENsize Attacker, under the head, "Our Smokeless Canser Powder the Best," an omission was made by the
temperature in copyring the original draft of the
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per cent nitroglycerin.

y per cent ures.

per cent soluble nitrocellulose.

\$216 per cent tri-nitrocellulose.

powder was made in two forms—one with and nd wave the better results, and was therefore Swaped composition. The formula for this nitro-its composition was omitted in my said article, that without the nitrogiverin being given; this correction. HUSSON MAXIM. New York, N. Y.

Utilization of Solar Energy

In the Editor of the SCIENTIFIC AMERICAN: so just read the article in the Scientific Ameri-OAR of January 21st describing Fessenden's scheme perhaps, but so cumbrous, with so much apparatus, and so much loss of energy in useless work, that its

age so much loss of energy in useless work, that its peccitical value is not very apparent. We shall soon, as world time counts, cease to use the feesil energy of the sun. Some intermediate pro-ceases, wind and water power like Fessendeu's, or the well-known conversion of the radiant energy into heat and this into work, may serve a pretty large purose for a transition time. But ultimately the world will use the direct radia-

tion energy from the sun to operate immediately

ory inefficient heat engines or wind plants.

This is the problem: To utilise for :mechanic power the electromagnetic energy from the sun di-rectly as electric energy, without transformation into

eat or any other form of energy. us problem I have presented to hundreds of young men in the engineering courses of the Pennsylvania State College; and some one of them may solve it.

And I have tried a good many experiments, such as the meager facilities and time at my command would permit for its solution. Dr. S. P. Langley, the late secretary of the Smithsonian Institution, replying to ing that I had written him about some of my work, said that he had done some work on this prob-I do not know whether any one else has tried or is now trying to solve this problem,

A tenth of one of the Carnegie research millions would lead to the solution of the problem. No other would read to the solution of the problem. No chair discovery in physical science would have such eco-nomic importance or so revolutionise life as the dis-covery of how to utilize the electromagnetic energy from the sun directly as electric energy for mechan-I. THORNTON ORMOWD.

Femenden on His Method of Utilizing Solar Radiation

To the Editor of the SCIENTIFIC AMERICAN:

In the sub-title of the article, January 21st, 1911, on my system for utilizing the energy of natural for mittent sources of power, the statement is made that "The difficulties in the way of its solution seem still to be very great. Whereas Fessenden assumes that water can be raised by the sun's rays to its boiling point, the highest temperature which is mentioned in scientific literature within our knowledge is 65 deg. C. or 149 deg. F."

It is unfortunate that the writer of the article did write me before publishing his critic would have been able to refer him to more than a score of scientific publications in which water was raised above 100 deg. C. by the sun's rays, without the se of mirrors or other focusing devices; in fact, such use or mirrors or other focusing devices; in fact, such experiments are so well known that I was not pre-pared to find the question raised at this state of our knowledge of the subject, or I would have given the references in my original article.

The example, in the first paper I take up, i. e. Prof.
Very's article in the Philosophical Magasine, Septam-ber, 1908, I find a record of two such experiments.
One on page 468, in which a temperature of 104 deg.

d. is reached, made by Prof. Very, in regard to which

d. is resulted, made by Prof. Very, in regard to waice fairs page):
The observation certainly shows that a solar radiation of the production of the producti

and the second s

can give at the earth's distance a temperature of 195

Still further down he refers to an experiment of ngley's as follows:

Langley obtained at his mountain camp on Mount Whitney, in a double hot-box of his own design, an excess of 98.5 deg. C. Goove shade temperature."

It is unnecessary to give further instances, but I would add that I have boiled water in an ordinary Thermos jar in January by exposure to the sun's rays.

A second point to be noted is that all the above re-

suits were obtained with ordinary absorbing means that none of the experimenters employed the metallic reflecting-band substances used with my sys tem. With these almost any temperature may be obtained, and I have melted solder in this way in a few minutes. In making this experiment the sun's rays were not, of course, focused at all, but fell perpendicularly, through screens transparent to solar radiation but not to the rays emitted from the oxidized surface of the solder. How hot it is possible to raise water in this way I do not know, as the steam pressure becomes too great after a few minutes for the glass to stand, so that I have never gone above about 100 pounds pressure per inch.

A third point to be noted is that the question of

what temperature can be reached has absolutely noth ing whatever to do with the practicability of my system. As every steam engineer knows, a low-pressure steam turbine will work at temperatures much lower than 100 deg. C. The temperature of 100 deg. C selected by me for quite other considerations. I intended originally working at a much higher temperature, i. e., about 300 deg. C., but was deterred by the difficulty and expense of holding in such high ures, though I may yet return to th count of the gain in thermodynamic efficiency

On the other hand, there would be no serious jection to working at a temperature of 90 deg. C. or

A temperature a few degrees above 100 deg. C. was chosen because the pressure on both sides of the glass would be equal, i. e., there would be no tendency to breakage. Also, because with this slight ex-cess above atmospheric pressure, there would be no

leakage of air into the condenser.

I trust that the above will explain all points not understood. REGINALD A. FESSENDEN.

Sun Dials in the United States National Museum

To the Editor of the SCIENTIFIC AMERICAN

The writer has given considerable attention in the past to the calculation of sun dials, and during the years 199-1910 has constructed a number of aluminum and brass and presented the same to the U.S. National Museum, Washington, D. C. where they have been added to the collection of dials there in the section of time-keeping devices. These dials com-prise: A universal dial, which operates in any latiprime: A universal that, when operators in any nat-tude without change of shomons and hour figures, provided the angles of the brackets that support it are changed to conform to the angle of the latitude of the place. Three horizontal dials, one for Nome, Alaska; one for Washington, D. C., and one for Panama; these illustrating well the changes that take place in the angles of the gnomons and the position of the hour lines in passing from high through intermediate to low latitude. A vertical dial calcuintermediate to low mattude. A vertical disc calcu-lated for Boston, Mass; a reclining cross dial calcu-lated for New Orleans, La.; a horizontal polar dial for latitude 90 deg., reading twenty-four hours; and a type of the ancient "moon mark."

It is possible, if the attention of the readers of the

SCIENTIFIC AMERICAN were called to these and the other dials at the museum, some of them might feel an interest in looking them over when in Washington, as the subject of dials has attracted considerable

attention in recent years. Baltimore, Md. CLAUDE L. WOOLLEY

The New Argentine Battleships

To the Editor of the Scutzmire Assaran:

The September 10th, 1910, number came to hand during the latter part of Coheer, and in said number there is a correspondence by a Mr. Harold M. Kannard rot the Argentine and United States dreadnoughts, and in which he compares the two types of battlebles. of battleships.

It was my intention immediately on reading Mr Kennard's letter to write you regarding same: owing to the distance which separates us and the time required for a letter to reach you. I concluded would be useless, as I expected that it would be criticised and rectified long ere a letter from me ne orticesed and rectined long ere a letter from me might reach you, feeling sure that among the many readers of the Scientific American there would be at least several who would "see the joke," so to speak; but after specifying several of the following numbers, I find that apparently no one has noticed Mr. Kennard's error. The last paragraph of said letter I will quote entire: "Finally, I would say, as a matter of neral interest, that I have learned on fairly reliable authority that the name of the second Argentine dread-nought is 'Acorazado.'"

This statement sounds strange, in view of the fact that only two weeks previous, in the August 27th number, on the front page, are cuts illustrating the two types of ships, one the "Wyoming" and "Arkansas," and above it the "Rivadavia" and "Moreno"

I fear your correspondent has been the victim of a practical joke as regards the "reliable authority" from which he received his information, and his state. ment has been the cause of considerable merriment in this city, as I wish to say, "as a matter of general interest," that the word acorasado is simply the ish for armored vessel or battleship

ian for armored vessel or natureally. The names 'Rivadavia' and 'Moreno' are of great men in Argentine history, and were given to two ships purchased from the Italian government and subsequently sold to the Japanese government, consequently it is only natural that the two new vessels should bear the names left vacant since the former two were disposed of Charles W Chute, Bosario de Santa Fé, Argentine Republic.

An Opportunity to Catch an Asteroid with a Small Instrument

By the Rev. R. W. Roberts

KNOWING that many readers of the SCIENTIFIC AMERICAN are interested in astronomy. I venture to call attention to the fact that Vesta especially is easy of identification during February. On February easy or menumention during February. On February sthand 23rd Vesta is near XI Cett and Mu Cett, whose R A and Der are respectively as follows: 2 h 23 m, 8 deg 4 min, and 2 h. 40 m, 9 deg 44 min, in both cases N Dec. See table for ephemeria of Vesta on these days. I add also ephemeris of Ceres and Juno, though the latter will be more difficult of identifica-tion on account of its lower magnitude, being nearly of the tenth during February Ceres is under the ninth, and should be an easy object Vesta is about the eighth during this month. By consulting a star map, the proximity of Ceres to easily detected stars is easily noted.

Vesta.								
		R			Doc			
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Feb. 1	7.96	2	16	N. 7	59	48		
Z		2	17	8	8			
ø		2	18	8	16			
4		2	19	8	24			
D		2	20	8	32			
6		2	21	8	40			
" 7		2	22	8	48			
" 8	+	2	23	8	57			
" 9	8.05	2	24	9	5			
" 10		2	25	9	13			
* 11		2	26	9	21			
" 12		2	27	9	29			
" 13		2	28	9	38			
" 14		2	29	9	46			
" 15 ,		2	31	9	54			
" 16		2	32	10	3			
" 17	8.14	2	33	10	11			
" 18 .		2	34	10	19			
" 19		2	35	10	28			
" 20		2	36	10	36			
" 21		2	38	10	44			
" 22		2	39	10	53			
" 23	+	2	40	11	1			
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25.	8 22	2	43	11	18			
26		2	44	11	26			
" 27		2	45	11	34			
" 28		2	46	11	43			
Ceres.								
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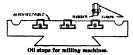
The World's Wheat Crop

According to statistics which the International Institute of Agriculture at Rome published not long since as to the world's production of wheat, the comparative figures for the total production are as follows: United States, 200; Russia, 194, France, 98; British India, 77; Italy, 52. Hungary 34 etc. As to the yield per acre of territory, the order is quite different, this being: Great Britain, 21. Germany, 19; France, 14; Austria, 13 2; Canada, 12 4, etc. The United States occupies the ninth place, with a figure of 9.2.



Oil Stops for Milling Machines

THERE are some milling machines that are not pro vided with oil pans, and that means a dirty floor ad the machine A simple oil stop can be inserted around the machine in the slot of the milling machine table, as shown in the sketch; a piece of rubber packing is cut to just the size of the T slot in the table, and two pieces of 3/16



inch sheet metal are cut about 1/32 inch smaller than the T slot. One plate is drilled and tapped for a 44-inch screw, while the other plate is drilled to suit the body of the 44-inch screw. The rubber is placed stween the two plates and placed in the T slot. After the stops are placed in position, the screw is tightened up, thus causing the rubber to expand and fit tightly around the T slots in the machine These oil stops will be found very handy around the machine shop.

To Sharpen a Bit

By W. D. Graves

PRACTICALLY all of the numerous wood-boring tools work on essentially the same principle as does the common spur bit; so a clear understanding of what is required in order to insure good work with one of these will prevent one from going far astray in sharpening any of the others. In order to arrive at such an understanding, one must note carefully each of the cutting members, for there are two, and consider its function.

consider its runcion.

The worm, the office of which is only to guide and steady the cutters, rarely needs attention; but, in case it has been damaged by contact with metal, it nay sometimes be somewhat bettered by a little careful work with a fine three-cornered file. With ordinary use, without abuse, the worm will remain in better shape than any hand filing can put it in, till the spurs and lips are worn beyond redemption any repair should be very conservatively undertaken, always and only with a view to bringing the part as nearly as possible to its original form

In the ordinary practice of filing a bit, the spur should receive attention first. This should be filed no more than is required to bring it to a keen edg the angle about the same as on a new bit. All

such filing should be done on the inside, as in Fig 1, except in case gross abuse has led to the bending of the end outward In such case the outwardly bent part (but no more) should first be filed off One should guard against filing the part any more than is absolutely necessary, for it is usu-ally the shortening of the spur that renders a bit worthless it is by having this spur suffi ctently long and keen to make a clean cut be fore the lip begins to raise a shaving, that a smooth hole is insured

It is this spur that differentiates the bit from an auger; its place being taken, and its work being but ill dene, by an upwar turn of the outer side of the lin in the case of the latter tool

Fig. 1. - Sharpening the spur

Having sharpened the spur stiention should next be given to the lip. The action of this is like that of a chisel; or, in that it is guided and restrained, more like that of a plane iron. Care should first be taken to give it sufficient "clearance", by which it is meant, that, after the cutting edge has acted, there should be no part of the metal which will touch the bottom of the hole. This is a very important matter,

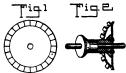
nd one which is often overlecked. Referring to the sketch, Fig. 2, the line AB is supposed to represent the bottom of the hole, while the irregular line is the outline of the much magnified and dulled edge of the lip. This edge should be filed to approxim the shape shown by the dotted line bc, making sure that there shall be a sharply defined angle Abo. This angle may be very acute, but it must be enough to make sure that there is an angle. One should do no more filing than is absolutely necessary here—in fact, it is not usually necessary to do any at all—but, after a proper bevel is insured by filing, as in Fig. 8, the bit should be turned to the position shown in Fig. 4, and the lip brought to a cutting edge.

In filing a bit one should always use a file with a safe edge," i. e., with one edge smooth, in order 'sate edge.' to insure his filing only that part to which he is giving immediate attention. A file like that shown in the photograph is made for the purpose; but one can do the work quite satisfactorily with a square file, one side of which has been ground or left smooth. Lacking this, a three-cornered file, two corners of which have been smoothly ground off at right angles with the face used, will do the work as well as my Of course, a file without a "safe edge" may be used but with such a one the utmost care will scarce suf-fice to avoid bungling the job.

Grooved Pulley for Experimental Work

By Edward Tiede

N working out small models of machinery and in experimental work generally, small grooved pul-leys are often required. To obtain such pulleys, a moid



of the proper size and shape is usually made, into a suitable metal is cast; a process which, though satisfactory, involves the use of a lathe and consider able preliminary work.

A very serviceable and, for most purpo ciently accurate, grooved pulley can be made without any elaborate preparations in the following manner: Take a piece of sheet metal, and with a pair of dividers mark two circles on it about a quarter of an inch apart; cut around the outer circle, thus form-ing a round disk. The edge of the disk is next divided into small sections, each about a quarter inch wide.



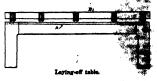


Fig. 3. -- Filing the lip.

Cut the sections apart to the inner circle, and then and the sections apart, one to the right and the next to the left, and so on all around the disk, being careful to have all of the same angle. This done, the pulley is ready to be mounted. An ordinary wooden spool makes a satisfactory hub for a pulley of this kind. Fit a shaft snugly into the hole of the spool, and drill a hole in the exact center of the pulley, and this map is the same content to the purey, but large enough to permit it to slide over the shaft. Slip the pulley over the shaft and against the spool, and fasten it with small breake or serves. If ordinary care is used, the puller will ruin quite true, '& pulley care is used, the puller will ruin quite true, '& pulley the puller will ruin quite the puller of this kind has the advangrip on the best, reducing It may be added that if a losse puller to piece of taking fitted into the speed as a instead of the shaft, will answer the puty drawings stinched hereto show in Fig. 1 hout the disk, and in Fig. 2 how the parts of

Laying-off Table

A SMALL laying off table is a very beat have around a small shop. It is make a laying-off table by building it



ground, but the table here illustrated is income comparison with those that are built on a fig.

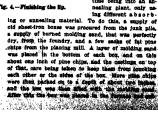
An ordinary table is made as shown. It is built to suit the cast-iron surface plate B. machine steel strip, shown at A, ¼ inch thick at inches wide, placed around the top of the frame of table. The frame is cut down to allow the street come flush with the top A number of %-inch add are drilled and tapped around the edge of the own; the number is determined by the six plate, as sh and weight of the surface plate Set acrews are piaced in the holes. At one and the set screws have a degree point. When the face plate is placed on the segree point. when the lace plate is placed on the table, the set-screws are run through, and the com-points will seat themselves in the strip A. These screws serve to level up the surface plate. When the table has been moved around on the floor and is not level, the set-screws may be adjusted to suit the floor, bringing the face plate level.

Shop Notes

To Anneal High-speed Steel.—High-speed steel is annealed by heating, not by cooling. It does not require more than twelve hours for a piece 2½ by 10 inches to cool. There are a great many ways in which this steel can be annealed. In place of a crucible use a cast-iron box and some cast-iron shavings one use a caseriom now and some cast-iron anavings from a planer or lathe, and pack your work in this. If you have not the shavings or box, take a gas pipe and pack the work in charcoal or ashes, dirt, clay, anything that will not burn on the work to be an-Heat it for seven hours, running the heat as high as 800 deg. C; hold the heat at this degree at night as sow dog. C; note the near at this degree at least five hours, then rates it to 900 dag. C. (cherry red); then shut off your fire and close your fur-nace door. Take out the steel after twelve hours. Steel treated in this way will be as soft as machine

Softening Hard Iron Castings .-- It happens quite that one comes across extremely hard cast-iron

castings that refuse to be drilled or machined. Some castings that broke by simply center punching them, were made by the following method as soft as common cast fron, and drilled as easily. The drilled as easily. castings referred to were very thin and considerably warped. They were intended to clamp a door tightly, but they invariably broke when pulling up the bolts. There being a wrought-iron heating furnace in the shop, it was converted for time being into an an-

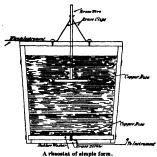




cted to a low heat for twelve heurs. When with-raids and silowed to cool, the castings were found to s perfectly soft and gave no further trouble.

A Home-made Rheostat

To make a simple rheostat, procure a small wooden pail or bucket. After it is dried thoroughly, give the inside a good coat of melled parafin. Cut two disks of copper, one and three inches in diameter resp san the disks thoroughly by scouring with tivety. Clean the disks thoroughly by scouring with emery cloth. Fasten the large disk to the bottom of the pall with a one-inch round-headed brass wood screw. Place a rubber washer between the disk and the botre the screw is driven in, to prevent the acidu



lated water from attacking the screw. A little solder will make a good contact between the two metals Then solder the one-inch plate to a straight brass or coppar wire, about No. 10 B.W.G. and eight or ten inches long—at least three inches longer than the pall is deep. Make a wooden support long enough to reach arross the pall, and drill a hole in the center large enough to let the wire slide through pleces of spring brass to the shape shown, and fasten with screws, so that the free ends grip the rod and hold it in position, and at the same time form a sliding nnector. The wire leading from the top should be dered to both clips, thus reducing the resistance a this point. The rod is pushed through the hole, and the wooden strips are nalled to the pail.

A solution is then made to fill the pail to within na inch of the top, composed of twenty parts of water and one part sulphuric acid.

When the upper disk is withdrawn from the solution the circuit is broken; but as it is pushed down toward the bottom, the resistance decreases until the two disks come in contact. Thus the quantity is regulated from come in contact. Thus the quantity is regulated from nearly zero to full strength. The smaller the quantity of acid mixed with the water, the greater will be the resistance, as pure water is not a very good conductor

resistance, as pure water is not a very good conductor.

This is a very cheap rhoestat, and readily built by
anyone at home in a short time. It is adjusted within
great limits, and has a large capacity; and if a heavy
current is passing, the best generated will be readily
absorbed by the solution

Simple Depth Gage

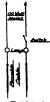
A SIMPLE depth gage can be made as follows: Take a piece of steel 5/16 of an inch thick and % inch wide and about 3½ inches long Drill a %-inch hole ngthwise in the end to one side of the center line About % of an inch from the and drill a hole 1/16 is



diameter, at right angles to and cutting into the first search of its diameter. Now this hole drilled to its higaged with a pine plug. The hole at the size its higage with a pine plug. The hole at the size with a pine plug where it with a plug where it with a plug with a pine plug where it with a pine with a pine

Electric Torch Lighter By Howard M. Nichols

BECAUSE of the carelessness of many workmen, it is desirable to sliminate matches from factory buildings. The electric torch lighter described below was designed with this end in view. The accompany



ing diagram shows the method of making the connections A line is run from the 110-volt lighting mains to a small board erected near the blow-torch On this board are mounted two incandescent lamps and a switch One lamp is in series with each side of the line, as shown Binding posts are provided, and leads of flexible cable, long enough to reach the torch, are connected to them. The ends of the cable have short pieces of stiff wire soldered to them When it is desired to light the torch, the switch is closed, the gas is turned on, and the two free ends of the cable are brought

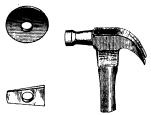
together and then separated in front of the torch,

together and then separated in front of the torch, the routling spark firing the escaping gas.

The size of the spark can be varied by using different sizes of lamps. The larger the candle power of the lamp the stronger the spark will be. It should never be attempted to work this system without the lamps in circuit, as a short circuit, that would make a big fissh and possibly burn the operator, would be the result of such an attempt.

Fastening a Hammer Head to the Handle

THE following method of securing hammer heads to handles may prove useful. It consists in taking an ordinary washer, cutting it away at opposite sides, and then beveiling it to form a wedge. When this is driven into the end of the hammer handle it is held firmly in place by the fibers of the wood that are

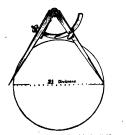


Hammer handle wedge made

d into the original washer hole in the center of This idea is not offered as something the wedge. new, but the average handy man has probably not heard of it, and may find it a very serviceable kink

Finding the Length of a Circle

THE mechanic's handy method of finding the length of a circle is as follows the first divides the



Finding the length of a circle with the divi

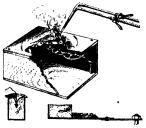
parts and adds it to the diameter. Then he sets the dividers to this measure (1 1/21 diameters) and tak-ing three steps with the dividers obtains about the exact circumference. The majority of mechanics pro-fer to deal with fractions with the divider points rather than with figures, which must always be used

1 71. 4

this calculation. The measurement obtained in this way is close enough for most kinds of work.

Casting Gold Centrifugally By Albert F. Bishop

DENTISTS have a very clever method of making solid gold castings A train of gears is employed, which revolves a spindle that carries two jointed arms. The outer end of one arm has an inclosure where the little mold is placed, while the the mold is a fireclay block, hollowed to receive the gold which is melted with the blowpipe. The gearing is rapidly worked by hand, revolving the melted gold, which is forced very quickly into the mold. Owing to contrifugal force, a very solid and clean cut cast-ing is made, which is free from blowholes. In mak-



Dentists' method of making solid gold castings

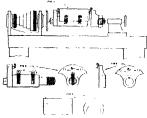
the mold, it is necessary for the dentist first to ke a pattern. This is done by filling the cavity make a pattern in the tooth with wax A wire attached to the pattern holds it in place while the clay mold is being made, as shown in one of the figures. When the mold is complete, the wax is melted out. Another figure shows a section of the mold as when placed on a rotary arm, also the block in which the gold is melted

How Crown Brasses are Turned By H. D. Chapman

THE accompanying drawing shows the way which a mandrel can be made and the way it is used for turning crown brasses for driving boxes on locomotives

Owing to the shape of these brasses, it makes a rather hard job to chuck or clamp the brass for machining, the brass being crescent-shaped in cross sec-tion as shown in Fig 4 Fig 1 shows the mandrel and the way in which the work is clamped ready for turning Fig 2 shows the end and side view. It is made of machine steel, and is simple in construction Fig. 3 shows the side and end view of the col-lar that slides over the end of mandrel. The key prevents the collar from turning. There are two 5/16-inth holes drilled in the head

of the mandrel to receive two center pins A, which are made a driving fit. The pins are allowed to project as shown Two pins B are made and driven in e collar, as shown in Fig. 3
There are two studs (' which are screwed in the



Mandrel for turning crown bra

mandrel as shown. On these study the crown brass rests, and they may be adjusted to suit different sizes When the brass is placed on the mandrel for machining, the nut on the end of the mandrel is screwed up, and the pins A and B will sink them-selves in the metal, holding the work rigid for ma-

chining

While this work is of a rather special character, it may suggest methods that will be found useful in other problems of lathe work.



The Inventor's Department

Simple Patent Law; Patent Office News: Inventions New and Interesting



tute for an Automobile Spring

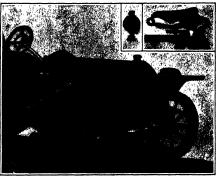
THERE has recently been invented by A California mining engineer a novel substitute for springs and shock absorb-ers on automobiles. This is a pneumatic cushion which appears to have advantages, because it permits the use of solid

The inventor of this new device has found it possible not only to construct a pneumatic shock absorber, but so to arrange this that it takes the place of the spring itself, while at the same time preventing any rebound.

In its present state this pneumatic cushion consists simply of a round rubber bulb six or eight inches in diameter, having an open neck at its upper end, and a small projection at its lower. This projection fits into a hole in a conical wood block that is secured to the axle of the automobile, while the neck of the bulb is set into a pipe fitting attached to the body of the machine. This pipe, of about 11/2 inches diameter, connects to a tank having a capacity of 2,000 cubic inches Four such hulbs replace the springs of an automobile. In fitting them to a car, the leaves of the springs are removed with the exception of the outer heavy leaf, which is used for steadying pures. All four tubes are connected by separate pipes to the tank.

he action of the bulb is as follows. on a wheel of the car passes over an obstruction, the bottom of the bulb resting upon the cone-shaped block is pushed inward, and the surface of contact of the with the block is increased. heavier the blow, the more the block neavier the blow, the more the block sinks in; consequently, there is a con-tinuously increasing supporting area within the bulb upon which the air acts, the air being under a compression of about 20 pounds to the square inch in the bulb, the pipe line, and the tank. As a result of the increasing flattened area in the bottom of the bulb under a heavy shock, there is a cushioning effect that increases with the blow, and when the initial shock has been absorbed, there is no rebound, since the air in the bulb, pip-ing, and tank has not been appreciably neck

A Pneumatic Cushion Substiwhen the bulb is flattened, in much the same way as it is with the tire; but in [our since cushons is 1,400 pounds, with



A pneumatic cushion substitute for an auton

consequently no liability of bursting.

se solid tires upon all commercial vehicles no matter what the size, as well as upon pleasure cars where it is desired to dispense with the costly pneumatic. The life of a good solid tire is easily double that of a pneumatic. For easily double that or a pneumatic. For heavy work eight 12-inch bulbs, using an air pressure of 80 pounds and deformed to 8 inches vertical diameter, will sus-tain a weight of 15 tons and have a maximum carrying capacity of 24 tons, while 16-inch cushions will carry minimum and maximum loads of 30 and 48 tons, re spectively. The rubber bulbs that have been tested in actual use are 8 inches in diameter with a 1%-inch orifice at the in use on neck. They are made up of six layers of springs.

owing to heating of the air, and | inch and a total contact area of 48 square inches at the bottom of the bulbs The air cushion makes it possible to the maximum load these 8-inch bulbs se solid tires upon all commercial ve will stand with the same air pressure, is 4,320 pounds. This would increase the contact area to 144 square inches, and flatten out the bulbs to about 5 inches vertical diameter, but there would still be two or three inches for further vertical movement in case of a sudden shock or blow. The air pressure in the bulb determines the strain upon the walls, and as this air pressure never increases perceptibly, it can be seen that the strain is not very great.

That this pneumatic cushion can be applied to any vehicle can be readily seen. One of our illustrations shows it in use on a motorcycle saddle in place

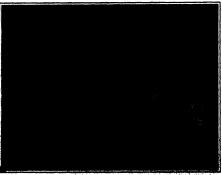
"Uncle Sam's" Automatic Dampening Machine By Thomas D. Gannaway

Y OUR "Uncle Sam" is the possessor of the first and only automatic dampening machine for dampening paper for plate printing in existence day. Although plate printing was in-vented in Italy nearly four hundred ago, but little change has been made in it since. The plate printer has had many of the same difficulties to con-tend with all these years in his effort to produce the best results from the engraved plate. As time has passed, great progress has been made in the art of engraving plates from which to print. The engraver has become more skillful in producing smaller and more artistic lines in his plate, thus making it still more difficult for the printer to reproduce the engravings upon paper. greatest obstacle he has met in all his career has been to get his paper in the proper condition for print-ing from an engraved plate. Plate printing is of such difficult nature that all work of a particular character (such as the printing of paper currency) has to be done by hand.

The printer, after inking his plate, takes a cloth and wipes it until the ink is all apparently wiped off; then he polseeming to remove every particle of ink he put upon it. But down in the hundreds of very fine depressions the ink still remains, and it is this ink that the printer must get on his paper. In order to do this satisfactorily, the paper must be wet and mellowed to a certain condition. If the printing is to be quite uniform, which is very essential in the case of paper money, all sential in the case of paper money, and the sheets of paper must be moistened exactly alike. Here is where the plate printer's real difficulty lies. If the sheet is mellowed down to the right condition, it will pick up the proper amount of ink, and the print will be amount of ink, and the print will be perfect; but should it be too soft, it will get too much ink, and the results are usually disastrous. On the other hand, if it is too dry, it will not take up



Fig. 1.-View showing the feeder of the dampening machine and hew paper



To the Control of the

enough ink, and the print will be too

and hence useless.

dreds of thousands of dollars have a spent by private conc pent by private concerns in trying roome this seemingly unsurmountable obstacle. Some of the most skilled chanical minds and the greatest ie aist culty and failed. It re mained for Mr. Joseph E. Ralph, Director of the Bureau of Engraving and Printing, and Mr. Benjamin Stickney, his mechanical expert and designer, to be the first men to reach this goal. Mr Raiph, after reaching the conclusion that the paper could be wet by machinery, and at the same time more perfect re-sults obtained in that way called in Mr. Stickney and discussed the plan with him. The latter, under the direc-tion of Mr. Ralph, set his mind to the task about one and a half years ago to work out the mechanical features of a machine by means of which all sheets of paper to be used in making money could be wet every one alike, and then put in exactly similar condition for the nista printer He could not devote his whole time to this one idea, as there were other mechanical features of his work which had to be looked after. Finally, having completed his designs, em to Mr. Ralph, wh ordered the machine built; and consequently in the government's big plate printing plant to-day, stands one of the greatest machines known to this indus-try, and yet one of remarkable sim-

In order to convey a better idea of the nany extraordinary qualities of this wonderful machine, I shall first describe the best approved method of wetting paper for plate printing at the time of the advent of the automatic dampening machine

in what is known as the wetting division of the Bureau of Engraving and Printing, a large number of men are employed to dampen about 400,000 sheets of paper per day. They use boards a lit-tle larger than the sheets of paper for a starting base. On this base is placed a wet cloth; then twenty sheets are placed on the cloth, and another wet cloth is laid on top of these Next comes another twenty sheets and another cloth, and so on until the stack contains 1,000 sheets of paper and a corresponding number of cloths. After being stacked the sheets are taken away and put under a slight pressure for 24

When taken out of the press, natu rally those sheets which were closest to the cloths contain more water than those in the center of each bunch of twenty Each such hunch has to be taken and split in the middle, and the two wet sides turned together and repacked wet sides turned together and repacked with a new set of wet rags. The sheets are than put back into the press for another twenty-four hours The cloths after use must be washed before they can be used again. They take up a great deal of the animal matter conless they are taken out at the prope less they are taken out at the proper time and well washed, they will sour, thereby injuring the quality of the pa-per. The men who moisten this paper must, before entering the work room, don some old clothing, as it is impos-sible to escape being solied. Notwith standing all of this care and the trouble of handling the paper twice, the wet-ting is not thoroughly uniform, as will

When a sheet has received the prope What a sheet has received the proper estacut of moisture, it has expanded in Inch. Now suppose the printer gets three sheets of paper. One of them has the proper amount of moisture in it, said has axpanded in Inch; the second is two wet, and has expanded, any it is to wet, and has expanded, any it is the third one has not received withing in policities, and consequently has expanded only about 8/16 inch. They gave iff if inch of the control of the cont

when they are thoroughly dried they have contracted to their natural width; therefore there will be a varia-tion of 7/16 inch in the size of the notes printed on these three sheets Also, the ones which were too wet are now too dark in color, and the ones which were not wet enough are too light in color. in color. Thus it can be seen that the printing is not perfect, and cannot be made so under these circumstances.

With the automatic machine it is al together different. As will be seen from the illustrations, this machine is quite compact. It requires but one at tendant, with one assistant giving one half her time

automatic feeder, which from the bottom of the stack, will open ate successfully under a stack of three thousand sheets, thus enabling the at tendant who looks after the feeder care for two machines at once. This feeder, which is a remarkable mechan ism itself, is one of Mr Stickney's in ism twent, is one of Mr Stickneys in-ventions. In Fig. 1, to the left, you can get a good view of it It slightly raises the stack of paper, and at the same time slips the bottom sheet (and only one at a time) tust far enough for it to be caught between two rolls These two rollers pass it onto a set of These two rollers pass it onto a set of canvas belts and under a corrugated roller (Fig. 2, to the left) to the point where it is caught between two sets of canvas belts (Fig. 1, near the conter). By these it is carried down through running water contained in a shallow basin in the center of the ma They also carry it out of th water up to two squeezing rollers made of rubber. (Fig. 1, to the right of the center of the machine.) These rollers are adjusted by means of set-screv (which may be seen in either illustra tion) so as to leave the required amount of water in each sheet. The paper ther passes over the large cylinder just to the right of the wringer, and is automatically caught and placed on its edge, as in Fig. 2. If for any a sheet is not properly placed on its edge, it is at once removed by the at-tendant and placed in the stack to her right. Otherwise she lets them re-main in the machine until the pack contains about one hundred sheets, then she

removes them to the stack. The attendant at the other end of the machine receives the paper in pack-ages of 1,000 sheets each. When she has placed 1,000 sheets upon the feeder, she puts in a sheet of another kind of paper as a marker for the one receiving it at the other end of the machine, thus the sheets are kept in packages of 1,000 each.

It has been ascertained that the required amount of water to properly mel-low 1,000 sheets of paper is 5 pounds A thousand sheets of dry paper on an average, 12 pounds and 6 ounces By weighing the paper before it is put into the machine and again afterward, it is easy to ascertain just how much water is left in it This is controll by the adjustment of the wringer. With this method all the sheets are wet exactiv alike, each individual one containing 35 grains, or 2/25 of an ounce, of

water when it leaves the machine.

The paper is carried from here in packages of 1,000 and placed in a humider for twenty-four hours or long if desired, or it may remain there eve for a week without injury "humidor" is merely an air-tight case where the paper is put to properly mel

where the paper is put to properly mel-low it for printing.

The dampening machine, after being properly adjusted, will run indefinitely, automatically feeding, dampening, and packing the sheets. It has a cap of 48,000 sheets in seven hours. Thre attendants can operate two machines, and the work is quite clean, in contrast with the old proce

est every taxpayer, is the saving which ture of their products.

it effects. Under the old method it cost the government 52 cents per thousand sheets to dampen the paper, while with this machine it can be done for 14 cent per thousand. This makes a saving of \$18 24 per day on each machine turn-ing out 48,000 sheets, making a total of about \$42,000 per year.

Changes in the Patent Office Staff

E DWIN LYON CHAPMAN, Examine of Trade Marks and Designs in the United States Patent Office, died at his residence in Washington, D C, January 18th. 1911.

Chapman's term as Examiner Trade Marks was undoubtedly the most remarkable in the history of the Patent Office. He was examiner in charge at the time of the passage of the Trade Mark Act now in force, and was the presiding genius in organizing, not only the busi-ness methods incident to the inauguration of the registration of trade marks under the new law, but was also responsible in large part for the procedure and practice found necessary in carrying out the purpose of such law.

He was a man of much force, had s strong intellectual grasp of the legal problems involved, was untiring in his energy, was possessed of great faculty and won the admiration of all who appreciated his sterling worth as

Personally Mr Chanman had many lovable qualities, and strong attachments were formed between him and his inti-

He was a native of Ohio, but lived most of his early life in Monroe, Michigan As a young man he entered Cornell Univerm which he was graduated in 1881. After studying law and practising for a short time at Monroe, his Michigan home, he accepted a position in the Pat ent Office, where his real life work was lone, and where his strong individuality has left an enduring mark among the records of the office.

Mr. Chapman is succeeded by Mr. John H Carnes, who has been promoted from first Assistant Examiner to Principal Ex-

aminer, and assigned to take charge of the division of trade marks and designs Mr. Carnes was born at Jersey City, entered Rutgers College, New Bruns N. J., in 1891, and was graduated from the civil engineering course in 1895. He practised civil engineering for several years, and entered the Patent Office in For a period of five years he served in various examining div isions, and for the past five years has been in the Interference Division, of which he was ranking assistant at the time of his recent promotion During his term of service in the Interference Division, he handled most of the trade mark interferences, and thus became fam iliar with the substantive law of trade marks and inter partes procedure in trade mark contests He is a trained lawyer, a member of the bar of the Court of Appeals of the District of Columbia, and comes to his new office with an experience that eminently fits him for his respon

The Patent Office and trade mark public are lic are equally to be congratulated on his acceptance of the appointment

Safety Devices .- In no way can invention be more profitably employed than in providing means for the protection of life and limb in the operation of power-driven machinery. The liability of an employer for injuries to an employee in certain cases is such as to cause him to be diligent in seeking all safety devices that can be used to advantage on his ma chines; and invariably if the choice is to be made between two machines, otherwise equal, the safe machine will be given Another very important feature about the preference, and manufacturers should this machine, and one which will inter- pay more and more attention to this fea-

Brief Notes on Inventions

An Inventor in Congress.—The Hon. thought to be the only member of the House Committee on Patents who been granted patents for inventions. He, because of being a patentee, had a special claim to a position on the committee. He has served on the committee through the 61st Congress and his term, ether with those of a number of his associates on the committee, will expire March 4th, 1911

Principal Examiner A. G. Wilkinson Mr A George Wilkinson, Principal Ex-aminer of Division 20, of the United States Patent Office, was appointed July ist, 1864, entering as an assistant exing Corps, having been promoted to the office of Principal Examiner on May 15th. Mr. Wilkinson has seen many missioners come and go, and has been missioners come and go, and has been familiar with the progress of the Patent Office during the past half century. Mr. Wilkinson hopes to round out a full fifty years of service, when he trusts a grateful government will be operating a etirement measure for faithful ployees

The Division of Interferences .-- Prior to 1870 interference proceedings in the United States Patent Office to determine which one of two or more rival inventors claiming the same patentable invention was the first inventor, were instituted, heard, and decided by the primary examiner of the division having charge of the particular case. The office of Ex-aminer of Interferences was created by aminer of interferences was created by act of Congress July 8th, 1870, and Joseph Adams was the first Examiner of Interferences. With the development of the patent system and the enormous increase in the applications for natents many conflicts arise and the interference division is among the busiest and most important departments in the Patent

The Date of Conception of an Inven tion. -The inventor is the poet of things the realistic rhymster who reaches out into the realms of fancy and brings back. not a new verbal expression, but never theless a distinctly new idea. Just as the poet's idea is as nothing until fit tingly expressed, so the inventor's idea is vain until he has embodied it in some physical form. This is the foundaor's conception of his invention the time when he first puts it into tangible shape. As one decision says, "It is therefore the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention as it is thereafter to be applied in practice, that constitutes an available conception within the mean-ing of the patent law." The date of conception of the invention, completed as above indicated, is, when followed by diligence to a practical completion of invention, of paramount importance in of a contest.

The Board of Examiners-in-Chief: A Sugrestion.—The Board of Examiners-Chief of the Patent Office, consisting of but three members, is placed in a peculiarly embarrassing position in case one or more of its members becomes incapacitated by sickness or otherwise This is likely to occur at any time, and provision should be made whereby some Primary Examiner or other Patent Office official might be designated by the Commissioner to sit temporarily as ber of the Board This would doubtless require legislation, but necessary au thority should readily be granted by thority should readily be granted by Congress This would not only facili-tate the work of the Board in case of absence of some of its members, but would give the official so called upon a new experience and a new point of view which should prove beneficial, and would also permit the assignment some official, expert in the specialty of the absent member of the Board.

Patent Oddities

Bicycle Tretting Suiky.—in order to make a suiky that will be very light, and one in which the weight of the driver will be entirely removed from the shafts an inventor has adopted a bicycle design. The two wheels of the sulky are mounted in tandem, and are supported in a frame of the bicycle type, which is not only very light, but is also very strong The



shafts of the sulky are connected to the steering post of the front wheel of the steering post of the 'rront wased of the hispels, so that the wheel will follow the horse around curves and sharp turns. The tractive don't required with a vehicle of this sort will be practically trame of the windwheel, that carries the vanes. These vanes are triangular in

Shaft-centering Device.—Heretofore in order to find the center of a line of shaft----Heretofore in oract to find the centre of a fine of shared ing, it has been the common practice to suspend a plumb-line from the edge of the shafting and then to callper the shafting and measure back from a point shafting and measure back from a point on the floor under the plumb-line a dis-tance equal to the radius of the shaft. This process is rather slow and liable to be inaccurate. A much simpler meth



accompanying engraving it consists of an are shaped member furnished with a pair of anti-friction rollers which are pair of anti-friction rollers which assigned to ride on the shafting. A plumb-bob is suspended from the ends of the arred member. As a result of this arrangement the rollers move to one side or the other until the plumb-bob centers or the other until the plumb-bot enters itself directly under the shafting. The line to which the plumb-bot is attached may be adjusted to any desired length so that the plumb-bob will just reach the

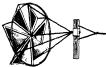
Pencil-sharpening Attachment.—A convenient little device that may be applied to a pencil, is illustrated in the accompanying grawing. This device normally serves as a finger hold, but contains a blade which may be moved into active position to sharpen the pencil. The blade



ing attach

s mounted in a U-shaped frame, contain ng a slot through which the point of the sencil passes when bringing the blade to active pection. This U-shaped frame erves as a guard for the blade, and obvites all danger of cutting one's fingers

Gyroscopic Kite.—A peculiar form of kite has recently been invented, which consists of a small windmill. This is revolved at high speed by the wind and, according to the inventor, produces a gyroscopic effect on the frame of the wheel, making the kite ride steadily in The kite string is attached to a the air. The kite string is attached to short bar, through which passes an ey bar. This is arranged to swivel freely Connected to the eyo-bar by means of a number of cords is the wheel or circular



vanes These vanes are triangular in shape, with one side secured to a spoke of the wheel, while the outer corner of each is connected by an elastic band to the wheel rim. The elastic hand permits the vanes to give in proportion to the strength of the wind

Hair-drying Fan.—in order to permit of faming the hair after it has been washed, a California inventor has devised a curious type of fan, which we il lustrate in the ac lustrate in the accompanying sketch. The fan consists of a flexible leaf secured to a bow-shaped frame, which in turn is pro



vided with a pair of handles pivoted to it The fan may be swung over the head, as shown, and will direct a current of air toward the head from behind as well as from in front, without diffusing or dissipating the air as in ordinary fans.

Combination Tool.—The accompanying illustration shows a combination tool recently invented, which may be considered typical of this class. It consists of a pair of pliers, with the jaws shaped to provide an ordinary nipple wrench, and con head of a wire nail when pulling such a nail. One of the handles of the plier is flattened to form a screw-driver, while the other is notched at the end to serve as a tack lifter. Mounted to slide on the



Typical combination tool.

screw-driver handle is a wrench jaw, bea ing the usual worm that engages a thread or rack in the screw-driver handle. The other member of the pliers carries a fixed jaw. One advantage of this arrangement lies in the fact that after the jaws have lies in the fact that arter the laws have been set, they may be tightened on to the work, by pulling the handles of the plier apart. Owing to this arrangement the tool may be used as a pipe wrench piper spiner. Owing the used as a pipe wrench.
One of the jaws is further provided with by the motion of the automobile. It consists a hammer head to permit of driving of a feat will be which is a font secured to small nails and tacks, while there is the a tage that passes over a pulley at the upper usual notch in each member of the pilers, since the passes over a pulley at the upper to be used for clipping wire, or the pilers, and the pilers, and the pilers is the pilers of the pilers of the pilers. usual notch in each member of the pilers, to be used for clipping wire,

RECENTLY PATRICED INVESTIGES. These columns are open to all painotices are inserted by special with the inventors. Terms on appli Advertising Department of the AMBRICAN.

The weekly index of Patents States Patent Office will be fo American Supplement.

Electrical Bortees,

ELECTRIC CHARLIGHTME.—V. E. ExTROM and T. G. Hoanman, Tonnahawa, Wis
It is the purpose of the control of the contransformed or suppose of the current can be
transformed or suppose from to a lower votiage and increased amperage, embiling the use
of a much concre and stronger wire, of artirely less expensive meterial, which will defeted to the control of the control of the contransformed properties of the control of the
space of time

of Interest to Farmers.

OF Interest to Farmers.

ANCHORING HARE FOR PORTS.—Prace
T Ballay, Newport, R. I The accompanying
engraving illustrates an improved anchoring
have for fence posts and the like, and provide
particularly a menus for securing suxiliar;



ANCHORING HABE FOR PORTS.

anchoring arms to the post or central spike. The central spike is formed of sheet metal corrugated lengthwise to give it it he necessary rigidity. The survivoing arms are Vahafied in cross section, and are secured to the spike by means of metallic fastlewers in the force of the country of the survivoir and the survivoir arms and the survivoir arms are survivoir as the survivoir and the survivoir arms are survivoir as a survivoir arms are survivoir as the survivoir arms are survivoir arms are survivoir as the survivoir arms are survi

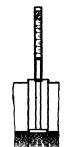
Of General Interest.

Of General Interest.

PIPE DNION.— B. Advarts, San Desp.,
Cal. The aim in this case is to provide a
usion more conjectify designed for joining adjacent main pips ends and making provides
or a branch connection, the union being arranged to permit convenient and quick assenting of the parts and fastening the same in
pines on the main pipe sonds, to allow resty
the continue parts, and the provide sufficient classticity for the detection of the pipes without
suspect of damaging the joint. isuger of damaging the joint

disuger of damaging the joint (ATE ADSTREMEL-W C. NEER, Kinsley, Kan. In the present patent the purpose of the invention is the provision of novel, simple details of countriction for fastening for a wintering gate, which will automatically lock the gate in closed condition when it is aways, the congagement with a eatch on a fence post or a like support.

FIGAT GAGE—F. L. LANDER, Rangor, Me In order to determine the amount of liquid remaining in a lank, particularly the gasoline tank of an automobile, Mr. Lander-has devided the construction shown in the ecompanying drawing. This gage will indicate the amount of gasoline with approximation accu-



PLOAT GAGE FOR GASOLINE TANKS

HOBERHOE.—B. F. Bacterov. Thomse Wash. An object here is to provide a silvet which a rubber or other resilient tread saw her may be attached with case. A familie tread saw her may be attached with case. A familie object is to provide sorved measure for bedding the resultant root of the same of the case of

vices. CIBRENCY BACK.—J. B. Moss, Decator, Neb. The object of the devices aboven in the accompanying sugarating is to hold bills of different characters in superspaced position, with each denomination by itself, so that access may be had easily to any particular bill or bundle of bills. The device consists of a



AME TOO NUMBES OF BILLS.

circular plate, with a central depression and a set of upriging located at regular integrals dividing the plate into sections. These sections is a section of the section of th

Hardware and Tools,

Mardware and a cours.

WHENCE C A Hardware 318 Main Street, Salinas, Cal lis order to provide a werends of the socket type which may be conveniently worked in places ordinarily inaccessible, Mr. Harritgeen has designed a tool with a shank in two sections physical together and



IMPROVED SOCKET WEENCH.

DATESUME ROUGHT WERECH.

with means for relatining the sections at different angles of adjustment. The socket section has a reversible ratchet mechanism, while with a bandle switch when not in the same instruction of the same in the s

THE PROPERTY OF THE PROPERTY O

apped to different angular positions with act to the blade.

agginated to different angular positions with simpler to the blade.

"Bhágain.—B. M. Bernaus, abbestills, N. C. The devention partials: more particularly." Co-ticle devention partials: more particularly. Co-ticle devention particularly are produced in hid the life, and adapted to man pipe while, the dies should be being removed from the pipe, 12 comprehends a neit-feeding remove reliably serviced to a frame mounted on a die stock or pipe has been threaded by the man of the die-tice of the service of the pipe.

LOCK.—W. Marua, New York, N. Y. This invention has reference more particularly to a device comprising a removable bolt adapted to secure in position a sang used for fusioning a course in position a sang used for fusioning a beauter in position as a service of the control of the passas for bolding the bolt is pisce at the santed of the door or other enclosures, and key-controllable means for actuating the movable shember.

STOVE PIPE HOLDER.—CROSS Les, STOVE PIPE HOLDER.—CROSS Les, South Whilely, Ind. Mr. Lee's device for essuring stove pipe in a chimny consists of two clamping members, one of which is disposed within the pipe, and the other on the atterior surface, the two members being connected by a server threaded through the inner member and passing through stols in the outer.



STOVE PIPE HOLDER

member and the stove pipe. When the screw is loosered sufficiently, the inner clamping seember will drop, permitting the operator to insert the pipe into the fine hole; thereupon the screw is tightiened to draw up the inner assumer and to hold the clamping members against opposite sites of the champers per wall.

ney wall.

AITOMATIC VALVE FOR WATER HEATERR.—W. E. KAY, Amberst, Ohlo. The invention provides a valve by mean of which,
will be automatically turned on and of simultaneously. The vaire is so shaped that it
satisfacts, Morsover, it cannot side is
its seaf, and fluctuations in the water pressure,
incidentaly to the ordinary jurning of and on
incidentaly to the ordinary jurning of and on
the valve.

the valve.

RADIATOR.—O. M. AYLAWORTH, Colling-wood, Ostario, Canada. The intention in this instance is to provide a radiator which will not take up say of the floor space in a room, and one which will not disfigure the wails, while it will permit a full flow of air from the room around the radiator and back again to the room. There is no danger of the entrance of smook, duelt, or askee into the room.

ines and Mochanical Bevie Manchines and Mechanical Devices, APPARATU FOR FILTENING BUGAL CANE JUICES.—K. MONTRING, Florida Blots, Raceland, La. The invention her illustrated shows an improved apparatus for filtering sugar come juice, adapted to distinate a maxi-mum of impurities from the juice and produce a better quality of sugar from the same grade of juice. The apparatus consists of a filter



FILTER FOR SUGAR CARE FUICES.

BY which delivers the judes to a set of open filter frame. By interposing the apparatus between the sail and the extractor the necessity of struming is disposed with after the sail and the extractor the necessity of struming is disposed with after in the sail of the sail of

series of blows which follow each other in quick necessites and are applied by means of quick necessites and are applied by means of the provided provided to the provided provided the circuit of the case where the blows are dealt by hand.

PAPER HOLDER.—B. F. PERTS, N. W. TROUBFROW, and H. S. McDaxuz, Mero, Ore. The investion on which the above investors lave obtained a patient relates to paper hold-lave obtained a patient relates to paper hold-lave obtained as patient relates to paper hold-lave obtained and provided the provided provided provided the provided p permitting the secape of lad smalls or odors. PIPB LAXING MECHANISM—3. H. SALING. Tuiss, Okia. This invention persists to a mechanism in the nature of a jeck, adapted to force a jupe through the soil without dis-sists a trench and disfiguring the surface. It provides a jupe-laying mechanism of the jack type with a point formed to cause a rotation of the jupe, thereby driving the jupe in a retilinear manner.

Prime Movers and Their Access

Prime Movers and State Accessories.

ROTAIN ENUISE.—C. E. Closey, Riegio,
N. N. The purposes here. E. Closey, Riegio,
N. N. The purposes here.

E. Closey and the continue of the continue of the committee of the

Hailways and Their Accomprise

Hallways and Their Accessories,
ASFETY STEPF FOR FREIGHT CARS,—A.

Natas, Loosard, Texas. The present invention has reference to improvements in
safety steps for freight cars, and it comproments, broadly, the production of a device
upon which the brakessan or other train hand
may stap with safety prior to racking the
hages; ordinarily employed, and the lowermost rung of the index on the cer said.

BATHING BOAT.—M. J. UPFORD, Amenia, N. D. The purpose in this instance is to povide a beat lawing nevel features of construction satisfies over features of construction satisfies or row boat, and further, that skapt the boat as a feat while bathing by either sex, artoring safety and privacy for females while oathing in the open six, without necessitating the warring of bothing saits.



Kindly keep your queries on asparate shorts of the property of the property of the property of ters as patents, subscriptions, books, etc. This will greatly facilitate answering your que-ferred to experts. The full name and address should be given on every about No attention to correspondents are printed from time to time and will be maited on request.

(12363) A. H. asks: We are having a (12883) A. H. asks: We are having a lot of trouble cooling down hot brase journals in an ice machine of 75 tons. When cooled by water they will heat up again as soon as the water is shut off, and the machine cannot be stopped. I have been advisable to use the place and oil. In the one of support and oil as the oil as the

quanties, sur Porting the orance is the only permanent curs. It seems (12.244 th W. O. C. writes. It seems (12.244 th W. O. C. writes. It seems to be a considerable of the conservation of the planets are, and again if does not seem possible that it can be any suppling place to our wording space. Where could I be enlightened a little on this at least? A. Much has been written upon space, but we have been been suffered by the property of the property of the property of the subject is found in our SUPPLEMENT NO. 1500, price ten cents, and the book "The Marra," by Simon Newcomb, price 12 postpaid, upon 11. (12325) L. R. BANKI. A. Wheel, BAY 4 wheel and 4 wheel and

gives consecuted catter for forming an opinion (12356) L. M., 8 says: A wheel, say 4 feet diameter, revolves on a 2-inch shaft. If the size of shaft is increased to 4 inches, will this fin turn increase the power necessary to drive the wheel? A. The leverage of the rifer of the shaft. Therefore the smallest ask: that will support the load under the actual working conditions of good or had lubrication, etc., without seltching or cutting will cause the actual working the shaft. Therefore the smallest ask: that will support and the same of the same of the shaft of the same of th

Johnston will reason and the property of the p

NEW BOOKS, ETC.

EXTENDED, 27C.

EXPONENTIALITY, S. P. JOHN Honderson, D.Sc., P.R.S.B. A.M.I.D.B. New York: Longmans, Green & Co., 1899.

165. pp. Price, 18 20 not.

This is the third of a series of physical and electrical engineering inhoratory manusis. The book has been prepared particularly for use took has been prepared particularly for use the prepared particularly for the color has been prepared as their varies course trittens, and represents a three varies course trittens, and represents a three varies course The first part appreciation their varies course to the prepared of the prepared of the second and third parts deal with silver current mary grande course. It has hook of experiments, primarily, and suggests work for the students to dust home during the week preveding the inhoratory course.

BKRMUDA, PAST AND PRESENT By Walter B Hayward, New York Dodd, Mead & Co., 1910. 18mo, 239 pp Price, \$1.25 net.

Mead & Co., 1940. 19mo. 239 pp. Price, \$1.25 net. Inib hook all the vivid color of Brunnia Inib hook all the vivid color of Brunnia Inib hook all the vivid color of the water and the second of the water and some by migrating to the coral-bound land of annahina, flowes delightful security, and personal apring. "Bermuda, Pust and Present" is not only an accurate and comprehender guide not only an accurate and comprehender guide and the price of the price of

LEADING AMERICAN MEN OF SCIPNCE, Edited by David Starr Jordan. New York: Henry Holt & Co., 1910 Price, \$1.75.

York: Senity Hold & Co., 1870 Price, York: Jensey Hold & Co., 1870 Price, 18.175.

This book contains short and sympathetic biographics of fitten leaders. In American science, each one written by a man in same work of the state of the stat

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Curiosities of Science and Invention

"Apple Locomotive" CALIFORNIA has long been classed

among the great fruit producing re-gions of the United States. In the matter of apple culture, Sonoma County, Cal., premium. . is considered the "banner" county of the

Very recently an "apple show" was held in the little city of Sebastopoi, Some acounty, lasting a week. The ex. hibition was one of the largest held on

the Coast, and was attended by im-mense crowds of visitors.

The most peculiar and attractive fea-ture of the entire fair was a huge, "life-size" locomo-

tive, built wholly of large, choices. The fram very large, choice apples. The frame-work was of wood, and over this were placed the apples.

chamber, headlight, cow-catcher, sand all of the necessary accessories of a regular railway engine—even to the number—"22."

This unique exhibit involved considerable time and no small expense. It is needless to add that it was the cen-ter of public admiration and curiosity, ter of public admiration and curiosity, and was awarded the very highest

Motoring on Runners

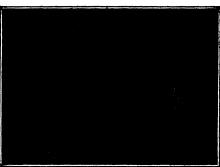
Recently this ma-

mounted on runners at high speed over roads and the ice of the river and creeks around Indianapolis. The differential of connected with the drive shaft. In fact, there is no drive shaft, as a chain combination connects the moto

placed in a apples.

The total length of the engine, in and the 8-foot propeller in the rear. There cluding the cab and tender, was nearly is only a six-inch clearance between the twent-year level, and it stood nine feet wooden propeller and the ice, and for this high from the "apple roadbed" up to the propeller and the season, and also because it frightens top of the smoothestack. There were a bell, lorses, it cannot be used much on the

The Austrian snow sutomobile shows herewith suggests another method of motoring over snow and ice. A simple number—"22."
The apple engine was a duplicate—
so far as number, proportions, and dinumber as a number, proportions, and dinumber as a number, proportions, and dinumber as a number as number



An Austrian type of snow automobile



An automobile mounted on skates and drives by an ele propulle.

Important and Instructive Articles on Aviation

In the Scientific American Supplement we have published in some of the more emissed physicists and engineers on fiying machines. No book this for published as occumplete and so authoristive as complete and so authoristive as occuping as it does the theoretical side of svisition as well as those more practical algorism. The following is a particles which have appeared in the Scientific American Supplement; see special note below.

see special note below.

g 1866, 1817, 1818, 1819, 1820, 1821
and 1822. The Frustien and Theory
of Aviation. By Grover Corolland Location, A. M. The is the loss compact
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SPECIAL NOTE

¶ We will mail [gratis] a list of many additional important papers, in the Supplement, treating of aeronautics. Ask for list A

Order, from your int MUNIN & COMPANY, L

ger Pier" Controversy at New York

bave drawn attention editorially to the fact that the huge dimensions which are being adopted for the intest steamships are not due to any mere whim of the steamship companies, her chief to motives of advertisement, but that they follow a strict eco-nomic law, according to which the larger the single unit of transportation, the less the cost per unit of freight or per or carried. The War Departm takes the stand that it is inadvisable tha the pierhead lines at New York harbor encroach any farther upon the available channel width of the Hudson River, which they claim is at present none to wide for the heavy traffic which passes up and down this waterway. The ques-tion, then, becomes one of expediency. Shall we slightly reduce the channel width of the Hudson River, and permit the development of the ocean steamship to follow its own natural laws without restriction, or shall we arrest this deveiopment for the sake of preserving the Hudson River channel at its present width *

To take a 100-foot strip from each side of the channel, or preferably, a 200-foot strip from the Manhattan side, would be to reduce the Hudson River from 2,750 to close of a long sea voyage before reach 2,550 feet, a reduction, say, of about ing the desired destination.

seven and a half per cent. New the importance of preserving the width of the channel may be fairly determined by comparing the conditions at New York with those of other leading harbors of the world. If the accommoda-tions at New York are more restricted tions at New York are more restricted of the SCIENTIFIC AMERICAN, discusses than at other ports, the serious character the new line of electric subway now in

seek some other terminal, such, for instance, as the new city docks at South Brooklyn It is sufficient answer to this to say that the traveling public demands that it embark and land as near the heart of New York city as possible. It was in answer to this demand that the Pe vania Railroad Company blasted out three million cubic yards of rock in the center of Manhattan Island; erected a vast terminal station; and drove its tu below the Hudson River; spending nearly one hundred million dollars on the enterprise. For the same reason the New York Central Railroad is spending New York Contral Railroad is spending a vast sum on its new station at Forty-second Street, it is the wish of the traveling public that the passenger steamship companies receive and disemsteamsnip companies receive and unsembark their passengers as near to these railroad terminals and to the hotel district of the city as possible. The argument has been presented that if passengers be disembarked at South Brooklyn some five miles from the hotels and rail way terminals of Manhattan, where they would have to take a subway fourney to reach the desired center, they might just as well be landed at Jamaica Bay, Montauk Point, or Boston. The length of the journey is not so much the objection as the fact that any railway journey whatever has to be undertaken at the

The Current Supplement

THE opening article of the current Supplement, No. 1831, which is from the pen of the Paris correspondent



wing the width of fairway at the world's leading

very evident. If, on the other hand, the moment, when the competition in naval available sea room for through traffic and armaments has pressed to the very utfor the maneuvering of big ships be much larger than at the other ports, this question of advancing the pierhead lines becomes of relatively less importance.

the case clearly, we have prepared the accompanying plan, showing the condi-tions at five leading ports of the world; from which it will be seen that the Hud-son River section of New York harbor, with its width of 2.750 feet, offers unrivaled facilities. The great port of Liv-erpoel has but 2,000 feet of width; London, but 1,600 feet; while the great port of Hamburg has available, with its 1,200 feet of clearance, less than fifty per cent of the channel width available along the western shore of Manhattan

We have spoken above of the question of the pier length at New York control-ling the future development of large coean steemships. That the port of New York will exercise this control is due to the fact that it is the natural gateway for the passenger traffic between the old and the new world. Nature has so willed it; and history has proved that no arti-ficially created conditions can divert the lines of steamship travel from these points of arrival and departure, which the geographical lay of the land has determined as being the best suited ints of arrival and departure,

Fry fin prypose.

It has been contended by these who are "Common Weeds on the Farm and Goppose to the lengthening of the piers dan," writes on "The Destruction that These gignst elementary will have to Weeds by Chemical Heans." A CONTRACTOR OF THE PARTY OF TH

of the proposed encroachment becomes operation in Paris.-Just at the present most the output resources of the great armament firms in England, Germany, and the United States, the views of Sir William White, as they appear in an With a view to presenting the facts of interesting paper on the subject of battie case clearly, we have prepared the tleship armaments to the Society of Naval Architects and Marine Engineers in New York, are of more than usual interest. Sir William's excellent paper is summarized.—In an article entitled "Some Notes on Telephony," Mr. H. Harsome Notes on Tesephony, ar. fr., ar-rison brings together concisely such fundamental and general information pertaining to telephony which is not readily available to the technical man not directly engaged in this phase of engineering activity.-Prof. Joseph W. Richards's excellent summary of the modern accomplishments of electro-chemistry is concluded —One of the greatest facts that modern astronomy has revealed is that our whole solar system is now fourneying toward the constellation Lyra This greatest of unselved problems of astronomy is simply discussed by Mr. Arthur K. Bartlett.—The Paris correanondent of the SCIENTIFIC AMERICAN writes on a project, which has recently been proposed to establish a navigable connection between Paris and the Finglish Channel, so as to convert the French capital into a seaport, and allow vessels up to 3000 tons to unload freight at the docks.—Mr. Harold Long, author of "Common Weeds on the Farm and Gar-



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Electricity

Portable Wireless Telegraph Sets for Use in Battle,—The Navy Department has purchased several portable wireless telegraph sets for use in battle. The seus have a range of about twenty miles. When clearing for action, the regular aerial of the vessel will be taken down, and the portable set installed instead. The portable sets may also be used to advantage by landing parties.

Surveying the Water Power of Japan.

Our Consul at Yokohama writes that the Japanese government is investigating the water supply of the country. This investigation is to be most thorough, and for the collection of data, thirteen offices have been established. In the meantime, no further concessions are being granted by the government, owing to the fact that it has been discovered that many of the concessions already given were secured for purely speculativ purposes.

Electricity Brought Down by Rain.A series of observations made in India by B. C. Simpson are published in a recent number of the Electrical Review and Western Electrician, which show that electricity brought down by rain may be positive or negative. The total of positive electricity recorded was 8.8 times the total quantity of the negative electricity, and the period during which the positively-charged rain fell was 2.5 times that of the negatively-charged fall, Treating the charged rain as equivalent to a vertical current of electricity, the current densities were less than 4x10-18 amperes per square centimeter, but on a few occa sions greater current densities, both pos itive and negative, were recorded. Purchase of Electric Power. - The cur-

rent used by the electric locomotives in the Detroit River tunnel is purchased from the Detroit Edison Company, and is stepped down from 4400 volts to 650 volts direct current by a sub-station "The energy," says the Electrical World is purchased on a maximum-demand as well as a kw.-hour basis, which makes it necessary for economical operation to eliminate as far as possible excessive peaks from the incoming lines. A storage battery has been installed to take care of the fluctuations of load, and the regulation devices are such that the first 800 amp, are taken from motor-generator sets; then the battery takes care of the load from 800 amp, up to 8360 amp.; that is, the battery takes 7560 amp. Any-thing above this figure is again taken from the motor-generators. The maximum load is 9100 amp. When this load is being carried the motor-generator sets would be delivering 1540 amp. (their full load rating) and the battery would be supplying 7560 amp."

Biplane Guy Wires as Antenna.—The principal obstacle to wireless telegraphy from aeroplanes, particularly biplanes, ss of guy wires, consists in the fact that these wires absorb of the energy and act as a shield for the antenna wire. After experiment ing for a long time with different meth dos of stringing a separate antenna. Mr. E. M. Horton has hit upon the idea of using these guy wires as his antenna. while for the ground he employs the motor of the seroplane. Experiments with a machine thus equipped, in the tical Reserve, in this city, have proved most successful, messages having been received from various stations through out the city, and even from ships at sea, desnite the fact that the seronisms was ocated on the first floor of the building and was not connected with any form of antenna on the roof. A very light equip-

Engineering

Cost of War,—Acc. ding to the onlow-lations of Edmond Thery, the French economist, the cost of maintaining the armed peace of Europe during the last twenty-five years was about thirty bil-lion dollars. During this time there has been constantly withdrawn from ; tive industry an average total of about four million men.

New Shine for the Navy .- The House Naval Affairs Committee has voted for the construction of two dreadnoughts, two colliers, eight destroyers, and four submarines. The new battleships may carry twelve 14-inch guns and reach 28,-000 or 30,000 tons displacement. It is mended that the new battleship "New York" be constructed at a private yard, the naval constructors having esti-mated that this will cost \$1,700,000 more if it is built at the Brooklyn navy yard.

Battleship "Texas" a Target, -In the annual target practice of the Atlantic fleet, which will be held on the southern drill grounds off Hampton Roads during the spring, the "Texas," the first battleship to be built for the United States navy, will be used as a target. She will be moored in shoal water off the capes of Chesapeake Bay, and highexplosive shells will be fired against the hull and superstructure at ranges of from eight thousand to ten thousand

Novel Railroad Bridge, -The new highway and railroad bridge to be built across the Willamette River, Portland, Oregon, which will weigh ten tons to the foot, will carry a highway and street car tracks on the upper deck, and the Harriman railroad lines on the lower deck. The latter will normally remain in a raised position for the pas an a raised position for the passage of smaller shipping, and will be lowered only for railroad trains. When lofty sailing vessels pass through, the entire draw span will be raised on towers to the necessary height.

Record Railway Run.-A special train on the Pennsylvania Railroad recently made the run from Washington to New York, 226.8 miles, in 3 hours and 551/2 minutes, or, excluding delays for ch of locomotives, etc., in 3 hours and 4834 minutes. This is 1 hour and 4½ minutes faster than the regular express ser vice schedule calls for. Excluding de vice schedule calls for. Excluding de-lays for change of lecomotives, the 90.5 miles from Philadelphia to New York was made at the average speed of 69 miles an hour. The 80.5 miles from West Philadelphia to Newark was run at an average speed of 22 miles an hour.

Triple Gun Turrets.—The Italians and the Russians will be the first to use triple gun turrets (turrets containing three guns) on their new ships. In a recent article in our columns, it was argued that the triple turret was the best because it gave the heaviest concentration over the widest are of broadside fire. The objection to the triple is that a single shot, well placed, might put three guns out of com out of commission at once. There is safety in wide distribution of the arms ment. The smallest risk to the guns and the maximum accuracy and sp are obtained when each must is mounted in a single turret.

Failure of a Large Oil Reservely,-The huge concrete oil reservely, with a capacity of one million barrels, re-cently completed at San Luis Obispo, Cal., and illustrated in the Scheriffo American of December 10th, 1910, vacently failed by the rupture of the concentry ration by the rupture of the order taining concrete wall. The tank was 601 feet in diameter, inclosed by a wall tapering from 6 inches at the top 60 feet at the bottom, and 50 feet, in height. A section of the wall 125 feet in beingth antenna or the total weight of which well the wall 18 feet in the fight in the figh

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TIPIC AMERICAN OFFICE.

An Avistor Punished at Law.—Van Heulen, an avistor who accidentally milled a woman at lay, has been sen- has elected former President Theodor tenend in Paris to pay a fine of \$10 for Roosevelt one of its corresponding mem carelessness, and \$1,000 damages to the bers; also the following carelessness, and \$1,000 damages to the woman's husband. Another aviator, month's imprisonment and a fine of \$75 for killing a girl at an avtation meet.

New Assentance Prison -- In addition to the prize of \$500 for a flight of a mile or more from shore, terminating with a landing upon the deck of a vessel, which was offered a short time ago by the United States Aeronautical Reserve, this organization also offers \$1,000 for the first oplane that leaves the deck of a vessel, akes a 10-mile flight, and lands upon the deck of the same vessel again. A prize of \$500 is offered for the first wireless message sent from an aeroplane by nember of the Reserve and received by another member 10 miles away E. E. Harbert, the president of the Illinois Aeropiane Club, has offered a prize of \$1,000 to the first aviator who will of \$1,000 to the first aviator who will carry him as a passenger from Chicago to St. Joseph or Michigan City, a dis-

The Money Side of Aviation.-That aviation is not only an enjoyable sport, but a profitable business as well, may be gathered from statistics recently pub-lished by a French automobile journal. According to that paper, the amount distributed in prises in 1910 was 4,705,500 francs. This figure does not include special sums paid to aviators for their appearance at different meetings. Louis Paulhan, with a total of 480,000 francs, won during the last two years, received extra for his flights in America. francs or more includes Paulhan, 350,000 francs: Latham, 289,500 francs: Morane 289,300 france; Grahame-White, 257,000 francs; Leblanc, 147,000 francs; Signor, 156,500 francs; Chaves, 156,000 francs; Capt. Dickson, 131,000 francs; Wynmalen and Mr. Sopwith, 100,000 francs.

of the 13th Infantry, U. S. A., made an now have 18-minute flight with Walter Brookins in Itali, etc. Wright biplane for the purpose determining the feasibility of scouting by aeroplane. He could see for a con-siderable distance by the aid of his binoculars, but he failed to locate a small body of troops that had left the Presidio Military reservation a few hours before He made sketches, drew maps, and took six photographs of the surrounding counplane has been used for scouting pu ses in America, and it recalls to mind the frontispiece published in our issue of December 19th, 1908, in which the Wright was depicted performing this service.

Bomb Dropping Experiments at San Francisco.—On January 15th a number of important tests were made at bomb drapping at San Francisco. height it was dropped the bomb tore a negant it was dropped use nomb tore a ("very ravorable" a quotient under 2.0; large hole in the ground and scattered "divorable," 20-24; "rather drovrable," the contents within a radius of 26 yards, 2.5-29; "rather undavorable," 3.0-39; "Shis is the first time that an actual bomb "unfavorable," 4.0-49, and "very unfa-has been used in seed, an experiment, [forable," 5.0 and upward.

Science

New Members of the Zoological So-ciety.—The Zoological Society of London bers; also the following foreign mem-bers of the society: B. Basu, Calcutta; J. M. Doctor, Bombay; Dr. R. Dohrn, Naples; Prof. Ludwig von Graff, Graz University; W. H. Osgood, Washington, D. C., U. S. A.; Mr. H. Pam, Caracas; Mr. R. B. Woosman, Navrobi; Prof. E. Lonnberg, Stockholm; and S. H. Scudder Cambridge, Mass

Madame Curie Defeated.—Madame Curie was defeated for election in the Academy of Science: Branly received one vote more than she. There can be no question of the value of M Branly's contributions to physics, and above all, to the art of wireless telegraphy, nor of his fitness to sit in the Academy as one of its most distinguished members. Yet one cannot but feel that Madame Curie's defeat was due entirely to her sex have sufficiently commented on this mat ter in our editorial columns Branly was the inventor of the coherer, which was such an important factor in the early stages of wireless telegraphy, al-though it is now hardly ever used, except for small experimental stations

Solar Radiation.—With the improve-ment of apparatus for measuring the intensity of solar radiation, this important element of climate will be more and more widely observed at meteorological stations. Statistics of solar radiation are much needed in connection with many researches, geophysical, meteorological, and biological We are therefore glad to learn that the Weather Bureau has under contract 100,000 francs a month siresdy taken the initial steps toward s The complete pyrheliometric survey of the list of aviators who in 1910 won 100,000 United States, though the consummation of this project is hardly to be looked for in the next few years. As a beginning, five stations are to be equipped with the new Marvin pyrheliometer. A self-registering pyrheliometer is a desideratum that Prof Marvin hopes to realise before long It is expected that we shall ultimately hav A Practical, Test of the Aeropiane charts showing the average intensity and Scout.—On January 18th, at the San total amount of solar radiation for all Francisco meet, Lieut. Geo E. M. Kelly parts of the United States, just as we now have charts of the temperature, rain-

The Variability of Rainfall.—A simple and convenient mode of expressing the variability of rainfall during a long period of years, which was used by A Angot in 1883, in his studies on the climate of Algeria, has recently been made the subject of a special investiga nade sketches, grew name, ...

Him the "variation-quotient of annual This is the first time that an aero-ratiral!" ("Schwankungs-Quotient der name for acouting pur sabrichen-Niederschlagsmenge") This tion by Dr. G Hellmann, and named by him the "variation-quotient of annual jährlichen-Niederschlagsmenge") "variation-quotient," which promises to be widely used in comparative clima-tology, is the ratio of the maximum to the minimum yearly rainfall, during the period for which observations are available. For example, a comparison of the rainfall records of 34 stations in northt bomb ern Germany extending over a period of Lieut, fifty years shows that their average varioropping at man Francisco.

Myron Criseye, of the Coast Artillery, allo-quotient was 22; 1. e., or an averdropped a special shrapped bomb from a sage the wettest year had 2.2 times as whether the small beight of 550 feet when flying in a much rainfall as the driest The small wright biplane drives by Parmalee. set variation-quotient found in this re-Wright biplane driven by Parmaise, est variation-quotient found in this re-Lieut. Crissey succeeded in dropping the gion was 1.8 and the largest 2.8, and in bomb with a considerable degree of ac-general it is found that this ratio does comparatively simple matter to hit an object the size of a battleship from a smallest variation-quotient likely to be height of 3,000 feet. The bomb he used encountered anywhere in the world in the experiment consists of a very thin is about 1.5. As uniformity in the shell of brittle white cast iron. It was amount of rainfall from year to year is fitted with a percussion sap and loaded advantageous for many practical matters with bullets and black powder. Its in which rainfall is a factor—specially weight was about 8 pounds. From the agriculture—Hellmann has classified as halsh it was dropped the bomb ters a "very favorable" a quotient under 2.0; "very favorable" a quotient under 2.0;





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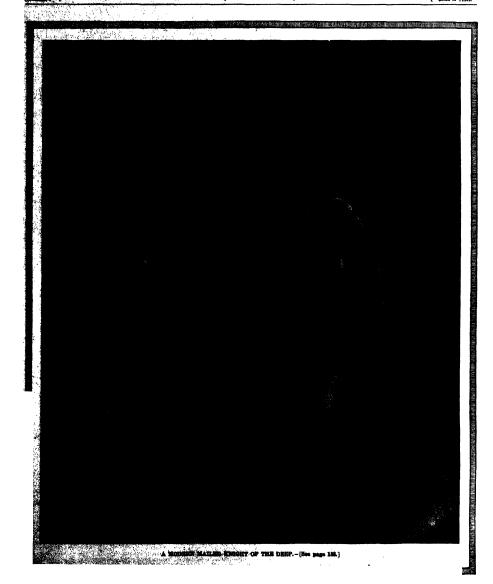
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The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to be present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

To Manage the Manager

HE Rapid Transit Subway in this city was built to carry, according to the most sanguine estimates of the engineers, a maximum daily traffic of 400,000 pasengers. At the present time it is carrying an average of 800,000 per day. This is a feat of trassportation (without a parallel in this is a feat of trassportation (without a parallel in this is any other city) which reflects the greatest credit upon the operating staff of the Interborough Company. Particularly mentiorious is the operation of the subway in the rush hours. Everything that modern engineering can do to asfely handle the vast crowds during these periods has been done. And yet it is a fact that the Interborough Company is greatly disilked by the traveling public; and the reason is not fat to seek. There is no doub that the chief reason for this unpopularity is the company's disobedience to the reasonable orders of the Public Service Commission for better car accommediation beforeen the rush hours. HE Rapid Transit Subway in this city was

und runnic service to unmission for sector car account modation between the rush hours.

The public has been particularly exasperated by the running of short trains at long intervals, after theater hours, passengers having frequently to wait a long time in cold, draughty stations, on crowded platforms, only to find the train, consisting of two platforms, only to find the train, consisting of two or three cars, already so packed with straphangers that no more can get on without peril. Often, after another long wait, a second short train may be found to be equally crowded, and a third may arrive before any seats are available. Such operation of the sub-way has naturally irritated the public and has pro-voked the bitter opposition to the company. When it is considered that all this has been done in arrogant disobedience of entirely reasonable orders issued, after public and patient hearings, by the Public Service Commission, it is no wonder that such an attitude has left a lasting impression, and

such an attitude has left a lasting impression, and has engendered a decided spirit of antagonism to

has engendered a decided spirit or antagonism to any further bosiness dealings with that company. The legal means which the Public Service Com-mission may employ for compelling obselface to its orders are inadequate and very clumsy. It has to proceed against the offending company by regular suits in the courts; where, after interminable arguments and delay, a fine may be imposed upon the ments and delay, a fine may be imposed upon the corporation, which, as a rule, is only a fraction of the additional money which the company has made up of the public by its persistent disregard of public convenience. The Interborough Company will have only itself to blame if the city seek relief through some form of drastic legislation.

some form of drastic legislation.

We believe, however, that a resort to the Legislature is unnecessary, and that the relation of the Interhorough Company to the public can be more efficiently regulated by the insertion of certain provisions in the agreement which will probably be made between the Interhorough Company and the city for the extension of the lines and their operation. One provision which we usuall particularly urge the city and public authorities to Insert in the

new contract is one to the effect that say can-pleyer of the interheasegh Company, or all stay company related to it for construction or apsendion, shall be immediately dismassed from service upon the order of the Public Service Commission, if, is the judgment of this Commission, the conduct af such employee shall be prejudictal to the public interest.

A provision of this kind would have the force law, and would be the most effective means for the Public Service Commission to control the offending corporation. A precedent for such a rule is to be found in every important contract for large work between railroad companies and contractors. It is contained, in most explicit terms, in the printed forms for large contracts for city work. It will be included in the contract for the construction of the additions to the subway. By extending its scope to include operation as well as construction (the new contract will cover both), the city will insure that the aubway shall be both bullt and run in the way it wishes.

way it wanted.

Past experience in large city and railroad contracts make it certain that the Public Service Commission will but rarely be called upon to exercise its power of dismissal; whose mera existence will act its power of dismissal; whose mere existence was as a strong deterrent upon employees against misbehavior. After the Commission has been called upon havior. After the Commission has been called upon to summarily dismiss a few offenders, the public would certainly be spared the spectacle of a General Manager of a corporation derlying and sucering at the reasonable orders issued for the safety and convenience of the passengers. Every employes, from the general manager down to the conductor and special guard, would know that his conduct would be subject to an immediate accounting to the controlling public authority. This would have the most saltary effect upon the management from top to bottom. An order from the Public Service Commission would then really be an order, instead of what it is now, merely a challenge to a legal duel in the courts.

Now that a new agreement with the Interborough Company is proposed to be made, the city should seize the opportunity to strengthen the hands of the Public Service Commission. The remody would prove to be writt and sure. By the adoption the public would be relieved from the present exasperating conditions and the Public Service Commission would be raised to a position of dignified authority.

The Communipaw Dynamics Dis

HE explosion at Communipare, Jersey City, of a large amount of dynamite, variously estimated at from 10 to 25 tons, must be reakoned as one of the most serious disseture of the kind on mated at from 10 to 25 tons, must be rectangle as one of the most serious disasters of the kind on record in the United States. Two carboals of dynamite stood on the pier, and the contents of one of these was being unloaded by silding the cases down an inclined chute to the hold of a stemmer. As the whisties sounded for the nooth ohir, there was an explosion of the dynamite in the hold of the reasel. Twenty-five or thirty workmen were killed, the steamer was blown out of existence, and the sievare, act up by the liberation of enormous voluntes of gas, wrecked the lighter structures in the violatity, and produced the usual phenomens of broken glass and violent shock, the effects of the latter being felt for a distance of forty miles. In ascidents of this character, any attempt to get at the causes must necessarily take the form of mere guesswork; sidd this for the reason that the only people who ceitld give any evidence as close eyewitnesses are invariably killed. It was so in the present case.

The disaster has been followed by the usual outborns of activity on the part of federal, state, and municipal atthorities, and it would seem as though every person that might be even remotely related to the explosion has been arrested. Drastic legistation is promised, and so forth, and so on—all of which seems to asver of the policy of latching the barn door after the horse has escaped.

Although the investigation of the disaster should be as thorough as the law can make it, the authorities should avoid panic measures and be careful not to lose slight of the saltent facts. In the first pince, dynamite, in spitte of its enormous destructive energy, can be and is made so each by modern methodering and the surface of the each of the energy can be and is made so each by modern methodering and the surface of the each of the energy can be and is made so each by modern methodery can be and is made so each by modern methodery.

to lose sight of the salient facts. In the first pince, dynamite, in spite of its enemous discrussive energy, can be and is made so safe by modern methods of manufacture, that it can be handled, shipped, unloaded and loaded with a large disgree of security always provided, of course, dath the civil laws which govern its shipment, and the physical laws which govern its shipment, and the physical laws which commercial dynamite for blasting purposes is now manufactured in such a way as to be exceedingly difficult to explode, except by special shiphlenose, it is still mabigate to that fruitful vision of sections, the uncertainties of the largest absence.

Contract of the Contract of th

stricks contents, were in the handlike of the property of the stricks and the

rying opposite the 11-raced accumer, passed curvey, in the certific order without exploding.

If, then, one carload of this consignment of dynamite was so extraordinarily insamfitive to rough usage, how came the other carlead, which was being loaded into the steamer, to blow up as it fall? The explosion may have been due to the fall of a case, the contexts of which may have suffered chemical deterioration; though this possibility is remote, the theorem of the present commercial dynamics being one of its marked characteristics. It is possible, also, that, the steamer being regularly employed in carrying high explosives, there may have been in the hold a small quantity of sitter givenering er some black powder which needed only a misor shock or the asker from a workman's pipe to start the mischief. Detonating caps of fulnimate of energary may have fermed part of the earge, and the accidental detonation of these would have been sufficient to explosion.

cion of these would have been summers, we capronite dynamics.

A member of our staff, who witnessed the explosion from the New York side, speaks of hearing the two distinct explosions, the first rather mild, followed by a second and greater shock. It is possible that the bollers exploided; in which event, the fiving metal and hot coals would prove sufficient predisposing

casses. Our governing bodies, "shether federal, state, or musicipal, should move oughtously in enacting additional legislation to safeguard the shipment and storage of dynamite. Dynamite enters so largely into mederar engineering and constructive work, that any measures which would tend to increase its cost or abook the freedom with which it can be carried to its destination and stored and handled on the work would have a serious effect upon the great constructive works in the fields of engineering.

work would have a serious effect upon the great constructive works in the fields of engineering.

As a matter of fact, what is needed is not so much stricter laws as greater care in the enforcement and observance of those we already have. Such facts as law's former to light regarding the Jersey City explosion seem to indicate that, in more quarters than one, there was gross lack of supervision and deliberate violation of the existing laws governing the transportation of high explosives.

How Leaves Keep Clean

HE shape of leaves is one of the first things a student of botany learns to distinguish. Even the most careless observer sees that some trees a blants have leaves with smooth, rounded edges, the most careless observer sees that some trees and pleats have leaves with smooth, rounded edge, while others have their leaves with most have leaves, with most remained with long points or divided into narrow lobes terminating in accepting or current cade. While there leaf shapes have feel cade, while there leaf shapes have forested a subject of study over since lotativeal selences has existed, it is only within recent years that the of the most remarkable purposes which the paths of foures serve has been clearly brought seet. It was shown, as the result of some special investigations used in Germany, that the fees purpose quickly limits off the recent of mosteries deposited about the foliage in heavy rains. This ready method, of disposing of e surplus of addressive significant to denie plants. It also cavives as a means of cleaner of disposing the surface of the leaves. Hours, derived to go on easily get rid of the rein-water; and if it has been actived that they remain starty and gifty start disposals.

John Ambrose Fleming, F.R.S.

The Noted Electrician and Wireless Telegraphy Expert

By P. F Mottelay

GHN AMBROSE PLEMING was born at Lancaster, November 19th, 1848, the son of the Rev James success American Filmentes was born at Lancasters. November 19th, 1848, the son of the Rev James Fiening, D.D., and received his first schooling at the University College School, London, which he entered at an early age during the headmantership of Prof 7 H Key He afterward attended University College El Key He afterward attended University College in preparation for the elogineering profession and after two years spent under such masters as Prof. Hirst, De Morgan, and Williamson while following up courses of private study, be graduated in 1870 as Banchelor of Relance He then entered the Normal Richeol of Releance He then entered the Normal Richeol of Releance He and others During 1872 and 1874 he acted as demonstrator in the laboratories of the Draw College of Chemister and Also as private of the Draw College of Chemister and Also as private of the Draw College of Chemister and Also as private of the Royal College of Chemistry and also as private istant to the late Sir Edward Frankland (1825 1898), whose name has been so prominently associated with that of Sir Norman Lockyer in spectroscopic and other researches At this period Prof Guthrie was d in founding the Physical Society of London and the first man to present a paper before the new society was Fieming who spoke on the New Contact Theory of the Galvanic Cell

During 1874 Prof Fleming was appointed Science Master and special lecturer on physics and chemistry in the Military De partment of Cheltenham College but reaigned early in 1877 to go to Cambridge There working in conjunction with Clerk Maxwell in the Cavendish Laboratory he made an elaborate investigation of and reon the British Association Standards of Resistance, mainly to determine their variation with temperature

In recognition of his great merits he was elected successively Exhibitor in Natural Science (1877) Foundation Scholar of his college (1879) Hare Exhibitioner Wright's Prizeman, and Hughes Prizeman the last being a special award annually conferred on the Foundation Scholar whe has most distinguished himself in mathematics and in natural philosophy

At the end of his third Cambridge year *(1879) he took the degree of Doctor of Sci ence in the University of London and that of Bachelor of Arts at Cambridge with special distinction in the Natural Science Tripos In 1880 he was appointed Uni versity Damonstrator in mechanics and in applied science under Prof James Stuart whom he assisted in the designing and con struction of the Cambridge Engineering ratories while at the same time lectur ing in the mechanical engineering work shops When University College Notting ham, was opened in the year following (1881) Dr Fleming was selected out of a large number of candidates as the first oc matics and physics of that institution. It was in this same year (1881) that electric lighting began to attract public attention The new field proved so attractive and premising to Dr Fleming that after a short residence in Nottingham, he resigned his professorship in order to remove to London.

where upon the organization of the Edison Electric Light Company (1882) he was appointed their elec On the amalgamation of the Edison d of the Swan companies during 1883 he continu as advising electrician to the new concern and in that capacity was naturally connected very promin ently with the first introduction of incandescent elec

In 1885 he became the first occupant of the newly ersated chair of electrical engineering at University Cellege, London while still retaining the chair of mechanical engineering which had been founded there several years before, and he succeeded, not very long after, in obtaining sufficient and to insure the much assessing acquironal accommonations for practical en-gistenering instruction. These were founded by the specifiest at University College of what now proves to be one of the most complete engineering and ele-trical laboratories. Its botal cost amounted to nearly £15,696. The inauguration of the new buildings took

on the friends of the late Sir John Fender, the Soldish pioneer of schmarine telegraphy and scholaded to erect a missional to him, it when the most suitable year of supressing

their appreciation would be to found a chair of electrical engineering at University College London and a sum of £5,000 part of the amount collected by public subscription was accordingly presented in advance to the college as early as July 2nd 1837 at a public meeting which was presided over by the Marquis of When the whole fund was handed over it is with the condition that it be used to maintain an electrical laboratory to be known as the Pender Laboratory and that Dr Fleming occupy the newly created Pender Chair of Electrical Engineering This still occupies at the present day

His interest in popular education always very great resulted in the establishment of the Morley Momorial College Waterloo Bridge Road London Since 1899 Fleming has been scientific adviser of th onl Wireless Telegraph Company and of late he has held the post of department editor of electricity in connection with the eleventh edition of the Encyclo

Among his most important scientific papers may be



PROF J A. FLEMING, F.R.S.

mentioned the one read puring 1885 before the in stitution of Electrical Engineers urging the necessity of a standardizing laboratory for testing electrical instruments which led to the establishment at Rich mond Terrace of the Board of Trade Flectrical Labora tory and later on to the National Physical Lubs

has delivered numerous courses of lectures be fore the Society of Arts and the Royal Institution fore the Society of Arts and the Royal Institution.

His Cantor Lectures at the Society of Arts were On Alternating Current Measurements Alternate Current Transformers Electric Oscillations and Electric Wayes,' and "Hertsian Wave Telegraph They were all translated into German and into Japanese and were republished in the United States Before the Royal republishment in the difference before the royal Institution he has delivered both afternoon and evening lectures. Some of those given on Friday evenings were entitled 'The Physics of an Electric Lamp 'Electro-magnetic Repulsion Electric and Magnetic Research at Low Temperatures. The Elec magnetic assessment at Low Temperatures The Elec-tronic Theory of Biectricity and Recent Progress in Electric Wave Telegraphy Those of the afternoon were on "The Induction Cost" "Biectric Humination "Magnetic Properties of Iron," and Wireless Teleg raphy," in addition to two special courses of Christ

mas lectures during 1894 189 respectively on The Work of an Electric Current and On Waves and Ripples in Water Air and Ether

In conjunction with Sir James Dewar he is the au ther of communications to be found in the Plylosophi 1882 1883 1895 (two papers) and in Proteedings Royal Society 1896 (six papers) 1897 (six papers) 1898 the last being On the Magnetic (six papers) 1888 the last being on in magacia.

Susceptibility of Liquid Oxygen the sufficed in the wind of papers on Problems of F1 tric F1 w in Networks of Conductors Moleculus Shadows in in endescent Lamps and The Use of the Daniell (ell as a Standard of Electromotive Force For the Company of the Comp on Flectromagnetic Repulsion he was awarded the silver medal of the Society of Arts

the anniversary meeting of the Royal Society held in London as usual on St Andrews Day No vember 30th 1910 its president Sir Archibald Geikie K C B presented to Dr Fleming the Hughes gold accompanying it with the following remarks For thirty years he has been actively engaged in re searches in experimental physics chiefly

in the technical applications of electricity lie was an early investigator of the proper ties of the glow lamp and elucidated the unilateral conductivity presented in its par tial vacuum between glowing carbon and metal a phenomenon which has been looked upon recently as connected with the important subject of the specific discharges of electrons by different materials H has published in the scientification technical press and in technical textbooks many admirable experimental investigations and valuable expositions in the application of electricity as to electric transformers and wire less telegraphy. Of special interest and value for them were the important results concerning the alterations in the physical properties of matter such as the remark able in rease in the electric conductivity of metals when subjected to very low tem peratures which flowed from his early col laboration with Sir James Dewar in invest! gating this domain. In recent years he has taken a prominent part in the scientific de velopment of telegraphy by free electric

lie is the author of a large number of ooks of which we shall mention only two Principles of Flettic Wave Telegraph 1906) Elementary Manual of Radio Telegraphy and Radjo Telephony (1908) The work published by Longmans in 1906 contains three appendixes which give the original wir less telegraphy act of 1994 the entry bibliography (books as well as original papers and lectures) and lists of British patents relating to the subject granted in 1890 190

Dr Fleming was el ted a Fellow of St John's College (ambridge in 1884) a Fel low of University College London in 1884 and a Fellow of the English Royal Society He is also a member of the Royal Institution of Great Britain and has been lent of both the Institution of Electrical En

gineers and the Physical Society of London

A New Farm Crop

WILLIAM H HOLMES Chief of the Burcau of American Ethnology at Washington 1) (not only eminent as an ethnologist but is recognized as a painter of very good pictures. He re ently a quired a small farm in one of the picturesque s tions of Maryland adjoining the District and shortly after the purchase was advised by Mi I a will known financier and prosperous farm i f the nigh weeds and meeting Mr P— all t vears residence on the farm Mr Holmes sail Wil Mr P—— 1 took your asvice about that faim. I haid \$1 800 for the farm haven't spent a ent on it in improvements and in the last year I have sold \$900 worth of sketches off that farm ad line I don't believe Mr Pyou could weat that yourself

First Flight of an American Aeroplane from the Water

How an Important Problem in the Naval Aeroplane was Solved

By John Fulton Greer

A POTENTIAL fact as regards the efficiency of the aeroplane in its connection with naval warfare was established Thursday, January 26th, when Glenn H. Curtiss in his experimental hydro-aeroplane flew

from the surface of the bay of San Diego, California, and after cir-cling about the tops of the masts in the harbor, alighted on the water with the case and assurance of a great sea bird. As in many other experiments of man in his world-old battle to conquer the forces of nature, there was the element of ac cident when success finally crowned the efforts of America's most scien tific aviator A small group of in-terested friends had gathered on the shores of the bay to witness a trial spin on the surface of the water, in which Curtiss proposed to test his hydroplane pontoons The machine hydroplane pontoons hydropiane pontoons. The machine was pushed into the water from the hangar erected upon the beach in front of Curtisa' recently established army and navy aviation school The engine was started and at the word to let go the maglided swiftly out toward deep water. As it gained speed the pontoons lifted until it was ap-parent to the aviator that his main water support was nearly out of water. As the head resistance and skin friction were reduced, the speed increased, and suddenly Curtiss realized he was getting dangerously near the shore "There was nothing else to do," he said afterward, "so I tilted the elevating plane, and "so I tilted the elevating plane, and to my surprise the machine rose from the surface of the water as easily as I had ever left the ground" At the required slittude Curtiss turned the machine toward deep water again, this time in the air, and after a few seconds aloft, alighted as gracefully as he had

Not satisfied with the first flight, Curties at once had his sasistants start the propeller; and, after a short run on the surface, he again ascended, circled over the channel, and alighted after one minute and twenty-one seconds in the air. He amounced to his friends that he was satisfied that the experimental stage of flying from and alighting on the surface of the water was at an end so far as he was concerned. Twice again during the day he made experimental flights, and the following day he went up and remained aloft three and one half minutes, stating when he returned to the beach, that he could have remained in the air until his supply of fuel was exhausted. The aero-

plane balanced as perfectly with the pontoons beneath the wings as it ever did on wheels, and the \$-cylinder, 50-horse-power Curtiss engine did its work without a miss.



Position of poutcons at the instant of rising from the water.



Snapshot of Curties gathering headway before flight.



Entering the water for the first trial.



Rear view, showing the main postoon.

THE FIRST AMERICAN PLIGHT FROM THE WATER

The pontoons or hotlow hydroplanes developed by Curtiss are of psculiar construction, alterather different from many nawspaper illustrations of his remarkable flights at San Diego. In reality, after a speed of their

age. In realization we are the consequence of the content of the c

This pontoon takes the place of the two rear wheels on the Curties type of aeroplane, and it acts with a hydroplane effect, rising to the surface of the water as the speed in-

In front of the main pontoon, at the point where the single wheel is attached on the ordinary land meldine, is fixed a small pontoon or "shoe" of approximately the same shape, eighteen inches wife, forty inches long, and six inches deep. This pontoon answers the same purpose or water that the forward wheel does on hand. Above the front pose of the same water of the same purpose of the same purpose or water that the forward wheel does on hand. Above the front pose of the same purpose of the same purpos

At the extreme forward end of the framework, and at about one foot lower level than the front of the small postcon, is attached a woods, bydroplane, six feet long, eight inches high and one and one-half inches high and one and one-half inches thick. This sittled at an angle of about twenty-five degrees and is incused to all of lifting the forward part of the machine when it is under

The forward elevating plane, allerone, main planes and rear cootrol are the same as the ordinary type of Curtles racing biplane, the main planes having a spread of twenty-six feet and a width of four feet and mise inches. The speed in the air is from 50 to 55 miles an hour.

McCurdy's Flight Across the Florida Straits

M. R. J. A. D. McCURDY, the well-known Canadian aviator, attempted the flight from Key West to Havana, Cuba, in his Curtiss biplane, on January Slat.

The start was made at 8 30 A M against a light breeze Four torpedo-host destroyers—the "Paulding," "Terry," "Drayton," and "Roo"—were stationed at intervals of ten miles, the "Paulding" being thirty five miles from Havan.

The miles from liavana.

At 8:34 McGurdy started Half an hour late: he was sighted by the officers on the "Ree," and in ten minutes he passed over the destroyer at a height of five hundred feet. All the forpede boats enitted black smoke in order to guide the aviator. He passed two of the three remaining boats in good style, and they were in hot pursuit, while the "Paulding" was will albed, teaming under forced draft. Suddenly, after he had been flying for about two hours and was within ten miles of Cubs, McGurdy seemed to settledown and light upon the water. A crack had de-

veloped in the crank case of his motor, and the lubricating oil had escaped. He decided to descend, although his goal was in view. His machine alighted easily, and was floated readily by the two cylindrical floats beneath the lower main plane. McCurdy was taken from the seroplane in a boat. An inclined platform had been constructed on the Faulding. For the purpose of drawing the seroplane on board, but this was broken, and the machine had to be hastled aboard.

McCurdy's account of the wonderful view apread out before him as he started on his light was graphed in the extreme. From a height of 1,000 feet the six seemed a huge panorama upon which the funnels of the destroyers showed as black spots in the distance. The appearance of the ocean as though painted on a vortical convex was apparently due to a littless effect caused by the recently risen sun and by McCurdy, elevation. It seemed but a short time to a him below Morro Castle and Entress hatfur cause hat a short cause of the control of the con

The distance of some ninetrals miles covered in less than two hours was traversed at about forty-eight miles an hour. McGurdy won \$8,000 by making this light from Eay West, the two prices of \$8,000 and \$3,000 being awarded to him despite the fact that he was mable to over the entire distance owing to the accident. The best previous record of a light over water was that of doma H. Qurties from Albany to New York above the Street Street, and the street of the st

His Life in His Hands

The Romantic Vocation of the Diver

By C. H. Claudy

TYRE man who sighed for the romance of the days of inglishs in armor never went down fitteen fathoms in a diving suit. During the chivarite ages, men incased themselves in armor to do mortal combat with those similarly equipped, and he who could best drive sword or lance through cold steel won the fight. But the man who incases himself in an armor of rould and cauvas, a halmst of metal such as Lancelot never wore, and shoes of lead, and goes down to fight the dangers of lack of sir, entanglement in wreckage, unusual pressure, and all the other perils of life and limb which are to

11. 1911

be found deep be-neath the surface of sea or river must have a courage and a quiet nerve beside which that of his t prototype is childish. For least, knight of old had light and air and dom of speech and action; the knight of the rubber tube works in darkness, in an element foreign and mical to and not only dan gles his life loos ly between his own fingers, but must put his trust for the very air he breathes patient men above, slowly, ceaselessly, turn-ing the wheels of an air pump.
It is surprising

to learn how many uses there are for divers The navy, course. employs many, to set sub marine mines and torpedoes and to attend to investigations of the ships' bottoms Every battleship has at least two h i g hiv-trained divers on her staff. Bridge conpanies use them caissons. as do those who build dams, water works, and rese Water voirs.

cities keep h dive on their staff constantly, and he has plenty to do. Wrecking companies need their services constantly, the new profession of under-river tunneling makes many demands on the time and side of the man in armor, and dock builders find it necessary to have a man willing to go beneath the surface in order to survey for pile setting, etc.

The profession of diving is more ancient than might be supposed. Aristotic speaks of men desconding in water in a "kettle" and during the reign of Charles V., two Greeks desconded in some sort of a diving bell. Fringing beek with them, alight, and to the wondersant and awe of all, a candle lit before they de-

Bit since Smeaton, in 1779, designed a pump to supprair lo, the diving bell, little vest improvement in the set has been made, save in detail of before and influent, until 'the investion of the integence. The propert advance query mide is the set, divine will bell the analysis of the set of the set, divine will bell ing suit. Before its advent, divers had to depend entirely upon pulls on the life line for communication with the surface and upon signs to each other, when under water, if two wished to communicate To-day the modern diving belinet is equipped with a trie-phone, and the diver can not only hear what is said to him from the surface, advise those in charge of his pump as to whether the air is "coming right" or not, and make reports as to the work in hand, but he can communicate to a brother diver and hear the instructions sent to him from the surface, all of which facilities

pend enmiration son disease, or "The bends," in which air gets into them
en, when tissues under pressure and causes the most extreme
Today
torture
a teletis said
succeed in their work. Certain classes of men are
en of his mere allowed to hoome alters, in these who with

As may be imagined, divers must be healthy men to succeed in their work Certain classes of men are never allowed to become divers by those who wish to train men for their work. Those always rejected for such service are 1 Men with short necks, fullblooded, and florid comploxions 2 Men who suffer from headach, are allightly deaf, or have recently had

a running from 3 Men who have at any time spat or coughed up blood. Men who have been subject palpitation of the heart. 5. Men who are very who are very pale, whose lips are more blue who are adject to cold hands and feet, men who have what is ly known as a poor circulation. 6 Men who have eyes and a high color on the cheek, by the interlacement numerous amail blood yes sels, which distinct 7 Men drinkers and those who have suffered severely and repeatedly from blood poison, or who have had rheumatiem stroke.

Finally, divers must be strong men physically, for not only must they sustain pres sure and work in heavy clothes with a great weight on their shoulders, but they must often exert much muscular force move objects below the surface or to dig or tunnel their way into a wreck in search of what they are after. Of course, the Of weight a man bears on his bears



Working the air-pump.

Cattles into the divine suit

THE KNIGHT OF THE DEEP AND HIS ARMOR

ties are of great assistance in the work. At first thought, it may not seem so difficult a thing, this gring down under water and breathing air sent in from a pump by a tube. But the physical drawbacks to the work, to take no account of the mental nose, are enormous. For every ten feet a diver descends, he sustains an added pressure of 4½ pounds over every square inch of his body. What this means may be batten understood when considering the greatest depth ever make by a diver—304 feet. His body at that depth sustained a pressure of 88½ pounds to the square took over and above the fifteen pounds always are took over and above the fifteen pounds always.

Diver must descend very nlowly, swallowing as they.

Otherwise they may bloed at the nose and ears and ered lose consciousness. And they must accord even mere slewly than they descend, particularly when coming from great depths, otherwise they may, titerally, burst from the internal sir pressure. At the Mess, 100, seading a rise may cause an attack of that

shoulders and the heavy lead weights upon his feet make less inroads upon his strength when he is bemeath the water, in fact, were it not for the weights, he would be more apt to rise to the surface than to stay down and work. But though the weight is madeless by the surrounding water, that same water closs bis every effort and resists his motion, so that a two-hour spell ten fathoms down is exhausting to the most practiced diver

When a diver is to descend, he must make many preparations. He must not eat anything for two hours beforehand, to commence sith, since according to an eminent medical authority. "Men working subject to great pressure should not cat an ounce more of animal food than is absolutely necessary some time before descending, as it increases the tendency to apoplexy."

The diver, getting ready to descend, clothes himself in very heavy underwear of guernsey or flannel, (Continued on page 148.)

Morning and Evening Stars for 1911

A Graphic Representation of Planetary Positions

By Prof. Frederic R. Honey, Trinity College

THE earth observer, from the egolistic vantage ground of his position, finds in the planets with their varying degrees of nearness and brilliancy, seven different stars of the morning and evening, which in their seemingly irrelevant changes keetheir appointments with the observer in obsdience to immutable law. THE . UN AND PLANNTS.

THE. UN AND PLANETS.
In a plot of the solar system, it is
not possible to represent satisfactorily
the orbits of all the pianets to the
same scale within the limits of the
same scale within the limits of the
spage if Nopium's orbit ware plotted
to the maximum possible scale, making
its diameter equal to nine and one-half
inches, the diameter of Mercury's orbit,
drawn to be obtained to the control of the
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jinch. For this reason the orbits are plotted in two separate groups. Flot 1 represents the orbits of the terrestrial planets, viz., those of Mercury, Venus, the Earth, and Marwhich are drawn to the same scale; and the orbits of the mklor planets, and kneptune, are shown in Flot 2, in which the scale is very much reduced. The proportion between the two scales is easily determined by comparing the diameter of the orbit of the Earth or of Mars in Plots 1 and 2. The Sun is the only body whose dimensions are large enough to be appreciable in the

drawing. In Plot 1 its diameter (=866,500 miles) would be repre one half of e—the dis-tance between a the center of the Earth's orbit and the Sun's cen-ter; and the Earth's diameter by a measure-ment less than one-hundredth part of this distance. The diameter of the giant planet Jupiter is nearly one-tenth that of the Sun; and it is evident that it would shrink to a mere point in Plot 2. The plane of the ecliptic is the plane of the Earth's orbit, and for convenience of reference it may be con-sidered as a horizontal plane. This is obviously an assumption, because in stellar space there is no plane of reference, and the words "horizontal" and "per-pendicular" lose their significance; but it is convenient to speak of a planet or of a satellite as "above" or "below" the scliptic The orbits of the planets are ellipses with the Sun at one focus. The plots show the projections of of the ecliptic, which on account of their small angles of inclination, do not differ very much from their true forms. In the plot of each or-bit that part which is above the ecliptic is represented by a full line; and the other part is below the ecliptic The line of nedes N N' is the of the orbit with that of

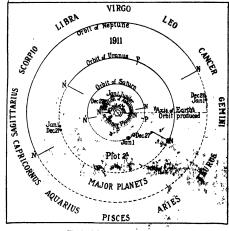


Fig. 2.—Orbits of the major planets.

Morning and Evening Stars
1911

Started of the Earth
Original Stars

Plot 1

Ogg

Fig. 1.--Orbits of the terrestrial planets.

TWO CHARTS THAT WILL HELP YOU TO LOCATE MORNING AND EVENING

cending node N is the point where the planet passes from the space below to that above; and the descending node N' where it passes from the space above to that below. The point P is perihelion, or point of nearest approach to the sun.

THE TERESTRIAL PLANETS.

PLOT 1.

On account of the great soccutricity of the planets orbit, Mercury's putting around the Bun clearly illustrates the first two of Kepler's laws:

Ill. A planet mouse is no dilpite orbit orbit orbit her Sun as one focus. 2d. The motivation around the Sun to the planet; desorrbee equel or motivation of the sun to the planet; desorrbee equel or motivation or major. The eccentricity is also greater than that of any other planet either terrestrial or major. The eccentricity is also greater than that of the orbits of any other planet of the contrict of the sun divided by the semi-major axis. The actual distance, or the links of the sun divided by the semi-major axis. The actual distance, or the links of the sun divided by the semi-major cardia. The actual distance, or the links of the sun divided by the semi-major axis. The actual distance, or the links of the sun divided by the semi-major axis. The actual distance, or the links of the sun of the triangle with the Sun as a vertice, and for a base that part of the orbit between the dates September 10th, is equal to the area of the triangle with the same averaged the triangle with the same of the triangle with the same as of the triangle with the same as the triangle with the same and the triangle with the same as the triangle with th

to that part of the August 5th and August 13th. The illustrations selected include perihelton and aphelion; and it is evident that in conformity with the law the planet's velocity varies between wide limits. The varies locities at perihelion and aphelion are respectively thirty-five and twenty-three miles per second. At a mean distance of thirty-six million miles, Mercury completes his revolu-tion around the sun in very nearly eighty-eight days; and the positions of the planet are shown for every second day. In order to syofd confusion, the dates are given only for every eighth day. Intermediate positions and dates may be interpolated by Mercury makes more than four revolutions during the year, four dates are attac planet passes orth and the Sun (inferior conjunction) Seb 25th; and three

The planets schit to technical at an angle of the Schroen; and the description which the CARLO CONTRACTOR CONTR

of the pisacts, is about a half a million miles—the position of the center of the orbit being scarcely distinguishable from the sun in the plot. As a consenoe, the variations in the velocity are very small; and Venus revolves around the sun at a mean distance of \$7.5 million miles with a velocity which is nearly uniform at the rate of 21.9 miles per second. The revolution is accomplished in 224 7/10 days. On angust 13th the planet very nearly reaches the same position as that of January 1st. The difference is the distance traversed in seven-tenths of a day The dates without the orbit refer to the first revolution; those within, to the second revolution. Venus is in inferior conjunction on September 15th The posi-tion of the planet is shown for every fourth day.

THE EASTH.

The earth's orbit, which is in the plane of the coliptic, has an eccentricity (==) of about one and a half million miles. The mean distance from the Rarth to the Sun, which is 92,900,000 miles, is diminshed at perihelion in January and increased at aphel-ion in July, i. e., there is a total difference of a little over three million miles. Moving at an average ve-locity of 18½ miles per second, which is increased at perihelion and diminished at aphelion, the earth

moves on the average nearly one degree daily

The position is shown for every fourth day. MARS.

The orbit is inclined to the soligitic at an angle of 1.85 degrees; and the center of the orbit C is 18.2 1.50 degrees; and the center of the orbit of is 12.2 million miles from the Sun. At a mean distance of 141.5 million miles, with a velocity of fifteen miles a second, Mars complete his revolution in 1.88 years Mars is at opposition on November 24th.

THE ASTEROIDS OR MINOR PLANETS.

The purpose of this article is to show the positions of those planets which are visible to the naked eye The asteroids occupy the space principally between the orbits of Mars and Jupiter. But the number is so great that a separate plot would be required to represent the orbits satisfactorily. Their positions are indicated in Plot 2.

THE MAJOR PLANETS

Table 1 gives the inclinations of the orbits, the eccentricity, the distance from the Sun, the orbital velocity, and the period of revolution Jupiter's position, as seen from the Sun, is indicated in Plot 1, at intervals of twenty-eight days; and in Plot 2 on January 1st and December 27th. The direction in which Saturn is seen in Plot 1 is shown at intervals of sixty days; and in Plot 2 on January 1st and December 27th The apparent motions of Uranus and Neptune are so slow that it is only necessary to represent their directions at long intervals of time.

CONJUNCTIONS AND OPPOSITIONS.

The positions of the planets in Plot 1 are shown for Greenwich noon at intervals of four days; and, with the exception of Mercury, at the dates of conjunctions and oppositions, which are given in Table 2. The shorter arrow shows a conjunction; the longer arrow, an opposition. They are omitted in the plot at the dates of the Sun's conjunction with Mercury, in order to avoid confusion in the flustration. A planet whose orbit is within the Earth's orbit, is morning star between the dates of inferior and superior conjun-tions, and evening star between the dates of superior and inferior conjunctions. A planet whose orbit is outside that of the Earth, is evening star before conjunction, and morning star after conjunction. both morning and evening star at the date of oppo-sition. The plot should be turned around into a posttion where the Earth in the plot is between the reader and the Sun at the date when it is desired to asser-tain the positions of the planets. A straight line drawn from the Earth to the Sun will divide the morning from the evening stars at this date. Those on the right will be morning stars, and those on the left evening stars.

	TABLE	1.		
Planet.	Exempton Millon Mules,	Telocity, Wires per Second.	Distance, Velton Miles,	Persod, Years,
Jupiter	1 03 23 3	8 1	483 3	11 86
Saturn	25 497	6.0	886.0	29 46
Uranus .	0 77 82 6	1.2	1781.9	84 02
Neptune	1.8 25 0	3 4	2791.6	164.78

TABLE 2.			
Planet, Conjunction,	Opposition.		
Neptune July 14 37	Jan. 11.0		
UranusJan 16.04	July 20.75		
Saturn Apr 30.75	Nov. 9.75		
Jupiter Nov. 18.12	Apr 30.67		
Mars	Nov. 24.71		
Venus Sept. 150 (inf.)			
Mercury Jan. 992 (inf)			
Mercury Mar. 20.04 (sup)			
MercuryMay 5.25 (inf.)			
Mercury July 3.54 (sup.)			
Mercury Sept 9 12 (inf.)			
Mercury Oct. 23.37 (sup)			
Mercury . Dec. 25.12 (inf)			

As Others See Us

Comments on the Scientific American by Readers and Contemporaries

To the Editor of the Scientific & MERICAN:

I am much pleased at the great improvement in the Scientific American in paper, type, and general make-up. It is a masterful piece of publishers work and editorial accellence. orial excellence.

The Scientisto American, which has for more than half a century been the greatest single scientific educator of the American people, ought to stand in the front rank of publications, not only in the respects in which it has so long stood, but in respect of the very guise in which it now goes to an appreciative

These newly embodied values are destined to come as a gift of the New Year and as a source of deep gratification to your thousands of admiring and ap-preciative readers, among whom I have been one since I could read, and among whom I expect to be one as long as my eyes last.
"Take the SCIENTIFIC AMERIC

SCIENTIFIC AMERICAN" IS a piece of advice fraught with blessings to those who take the advice.

To the Editor of the SCIENTIFIC AMERICAN

Congratulations on the new dress and incress tractions. The paper, typography, pictures, contents, are all improved. I like the plan of giving portraits of distinguished scientists and inventors. The monthly C. W. LEPPINGWELL. page on astronomy is useful.

To the Editor of the SCIENTIFIC AMERICAN:

write to express my gratification and pleasure over the articles which you are publishing on the American Museum and the Zoological Park The latter is really magnificent, and will help us enormously all over the country. Hence Fairwill Occurs.

President New York Zoological Society.

To the Editor of the SCIENTIFIC AMERICAN:

I have noticed a difference in the appearance of the A gave noticed a discrement in the appearance of the Scientific American in the past few weeks, and certainty congratulate you upon its attractiveness.

Collier's Weekly.

A. C. G. HAMMESPAHR.

To the Editor of the Schemitz American: I have come to look upon the Schemitz American as little short of a necessity to a man who is mechani-osily inclined, and I get from it many times its cost in the course of a year. Columbia, S. C. R W PARK

To the Editor of the Sometime Assumers

These to congressions on the soundary of the soundary of the soundary of the last edition of the Science of the last edition of the Science of the last edition of the Science of the Periodoceaner. I think I am a second the soundary of the periodoceaner. I think I am a second the soundary of the second the s

from about three years before your fire, until the present. I would like to see the improvement you will make in the next half century

Sincerest desire for your continued prosperity New Haven, Conn. T. SAULT.

To the Editor of the SCIENTIFIC AMERICAN:

Its name is good enough and its scope is big enough to cover every human interest I can see big possibilities in the SCIENTIFIC AMERICAN

MILES B HILLY.

To the Editor of the SCIENTIFIC AMERICAN: The changes of the general make-up of the Scientific American we think are a great improvement

New York, N. Y. THE COS-MORTIMER COMPAN

To the Editor of the SCIENTIFIC AMERICAN

I have been getting your publication at home, and probably read it more carefully than I do any other F B. SCHWARTZ, Charles H. Fuller Company. weekly or monthly. Chicago, Ill.

To the Editor of the SCIENTIFIC AMERICAN

I looked last night at the current copy of the Scientific American, and can certainly say that you are making progress in the direction of mechanical im-

revement.

Wishing you every success,

CHARLEN D. LANIER. New York, N. Y.

To the Editor of the SCHENTIFIC AMERICAN

Allow me to congratulate you noon the physical ppearance of the Scientific American of January appearar

Zist, which has just come to my deak.

It seems to me that this is an issue, irrespective of scientific considerations, which every man would want to read purely from the human interest standpoint

STANLEY CLASUR, Clague-Painter-Jones Company.

To the Editor of the SCIENTIFIC AMERICAN

Ever since the beginning of the year, and the change in the appearance of the SCIENTIFIC AMERICAN. I have en intending to write you a note of commendation

While I am greatly attached to old things, I must confess that the news columns and apparently new type, and at least the new setting of the Scientific AMERICAN, is very pleasing to me. I have read the SCIENTIFIC AMERICAN for about forty-odd years, and it has kept up a very dignified and interesting and up-to-date record of the things "that are worth while" in the agentific world. I hepe it will continue in us

good shape, and progress with the times, as well as this last step indicates that it intends to. I will also say that the additions to your advertising pages are quite worth white, as the advertising is of a character that is of interest to scientific men. ARTHUR H. ELLIOTT

New York, N. Y. Consulting Engineer-Cher

The Marine Journal congratulates its estee temporary the Scientific American upon reaching the sixty-seventh year of its publication with the begins of 1911. The establishment of this journal at the time when the development of the railroad, the steamship, and the telegraph were in their infancy was particu-larly timely, and the fact that its circulation has reached out from a merely local weekly to a journal read throughout the whole English-speaking world today proves that it has fully covered its chosen field,-

The Scientific American has filled out sixty-six years, and still is as fresh and young and strong as it ever was during these more than threescore years During the past of its existence it has been enlarged from time to time, adding to the scope of its simplified science, making it not only understandable but fascinating to the layman, and stating its great facts and principles in good, clear, plain English. To many it has become a necessity, and we do not know of any one of intelligence who does not delight to look over its pages, and who is not sure to find some thing of interest. The number of men it has instructed is legion. It has been a great schoolmaster in mechanics, practical achievement, and knowledge of me-chanical science. It takes on larger scope in the be-ginning of the new year; recasts its make-up in typography, which will make it even more popular than in the past; adds to its pages, and issues a monthly appendix, and all for the same price, but it will still hold to its standard of accuracy and authority—From Signs of the Times (California)

Among the most highly valued perioduals which come to the editor's desk is the Schanne American, and, as our readers know, we frequently quote from it or reprint from it, thus giving subscribers to The Advance the benefit of a little of the important scientific information which fills its pages from week to week Our contemporary celebrates the heghning of its sixty-seventh year by increasing the size of its regular issue to twenty-four pages and by the use of a more attractive style of headings and make up which make it even more appealing than heretofore, and it promises even better material—a promise which it will be difficult to keep. May this useful journal con-tinue to enjoy its increasing popularity.—The Prop-byterion Advance,

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

A Scientist on Golf Science

136

To the casual looker-on there is a fascination in watching the graceful flight of the golf ball. To the devotes of the game, the tricks and whims of the soaring sphere have a peculiar and special interest But from a scientific point of view also, the phenomena presented by the projectile shot from the golfer's club present problems of interest.

The subject of the flight of the golf ball, treated from the point of view of physics, formed the theme of an address delivered by Professor Sir J. J. Thomson befare the Royal Institution. We quote here the eminent physicist in his own words:

"If we could send off the ball from the club without spin, its behavior would be regular, but uninteresting; in the absence of wind its path would keep in a vertical plane; it would not deviate either to the right or to the left, and would fall to the ground after a comparatively short carry. "But a golf ball when it leaves the club is only in

"But a golf ball when it leaves the club is only in rare cases devoid of spin, and it is spin which gives the interest, variety, and vivacity to the flight of the ball. It is spin which accounts for the behavior of a sliced or pulled ball, it is spin which makes the ball soar or 'duck,' or

execute those wild flourishes which give the impression that impression that the ball is end with an artistic temperament, and per-forms these eccentricities as an acrobat might throw in an extra somersault or two for the fun of the thing This gives an entirely wrong impres of the tempera-ment of a golf ball, which is, in reality, the most procesic of things, knowing while in the air only one rule of conduct, which it obeys with unintelligent conscientiousness. following its

nose This rule is, the key to the behavior of all balls when in the air, whether they are golf balls, base balls, cricket balls, or tennis balls. Let us, before entering into the reason for this rule, trace out some of its consequences. By the nose of the ball we mean the point on the ball far-thest in front. Thus if, as in Fig. 3, C the center of the ball is moving horizontally to the right, A will be the nose of the ball; if it is moving horizontally to the left, B will be the nose of the ball; if it is moving horizontally to the left, B will be the nose if it is moving in an inclined direction CP, as in Fig. 2, then A will be the nose

"Now let the hall have a apin on it about a horicontal axis, and suppose the hall is traveling horicontally as in Fig. 3, and that the direction, of the spin is as in the figure, then the nose 4 of the hall is moving inward, and slace by our rule the hall tries to follow its nose, the hall will rise and the path of the ball will be curved as in the dotted line. If the spin on the hall, still about a horizontal axis were in the opposite direction, as in Fig. 4, then the nose 4 of the hall would be moving downward, and as the hall tries to follow its nose it will duck downward, and its path will be like the dotted line in Fig. 4.

"Let us now suppose that the ball is spinning about a vertical axis, then if the spin is as in Fig. 5, as we look along the direction of the flight of the ball the nose is moving to the right, hence by our rule the ball will move off to the right, and its path will resemble the dotted line in Fig. 5; in fact, the ball will behave like a siloce ball. Such a ball, as a matter of fact, has spin of this kind about a vertical axis.

nas spin or this kind about a vertical axis.
"If the ball spins about a vertical axis in the opposite direction, as in Fig. 6, then, looking along the
line of hight, the nose is moving to the left, hence the
ball moves off to the left, describing the path indicated by the dotted line; this is the spin possessed by

a 'pulled' ball. If the ball were spinning about an axis along the line of flight, the axis of spin would pass through the nose of the ball, and the spin would not affect the motion of the nose; the ball, following its nose, would thus move on without deviation.

"Thus, if a cricket ball were spinning about an axis parallel to the line joining the wickets, it won not sewere in the air; it would, however, break in one way or the other after striking the ground; if, on the other hand, the ball were spinning about a vertical axis, it would swerre while in the air, but would not break on hitting the ground. If the ball were spinning about an axis intermediate between these directions, it would both swerre and break.

Excellent examples of the effect of spin on the

"Excellent examples of the effect of spin on the flight of a ball in the air are afforded in the same of base ball; an expert pitcher, by putting on the appropriate spins, can make the ball curve either to the right or to the left, upward or downward; for the sideway curves the spin must be about a vertical axis, for the upward or downward ones about a horisontal axis.

"Before proceeding to the explanation of this effect of spin, I will describe some experiments which illustrate the point we are considering. As the forces actThe beam carrying the cylinder is adjusted as that the blast of air strikes the cylinder symmetrically; in this case, when the cylinder is not rotating, the impect against it of the stream of air does not give rise any motion of the beam. If, however, the cylinder is set spinning, then as soon as the blast strikes against it the beam moves of sideways. It goes of one way when the apin is in one direction, and in the opposite way when the direction of spin is reversed. The beam rotates in the same direction as the cylinder, which is just what it would do if the cylinder were acted upon by a force in the direction in which its nose (which, in this case, is the point on the cylinder fast struck by the blast) is moving.

struck by the blast; is moving.

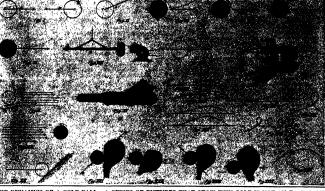
"We shall now pass on to the consideration of how
these forces arise. They arise because when a rotating body is moving through the air the pressure of
the air on one side of the body is not the same as that
on the other; the pressures on the twe sides do not
balance, and thus the body is pushed away from the
side where the pressure is greatest.

"Thus, when a golf ball is moving through the air, spinning in the direction shown in Fig. 8, the pressure on the side ABC, where the velocity due to the spin-conspires with that of translation, is greater than

that on the side ADB, where the velocity due to the spin is in the opposite direction to that due to the translatory motion of the ball through air.

ball through air.
"It is easy to
show by an experiment that
this is the case,
and also that the
difference between the pressure on the two
sides of the golf
ball depends upon
the roughness of
the ball.

"In the instrument shown in Fig 9 two golf balls, one smooth and the other having the ordinary bramble markings, are mounted on an axis, and can be set in rapid rotation by an electation by an elec-



THE DYNAMICS OF A GOLF BALL. A SERIES OF PICTURES THAT SHOW WHY GOLF IS NOT AN EASY GAME

ing on the ball depend on the relative motion of the ball and the about and the alere of ball and the about the alere of ball and the ball are with the velocity V. the forces will be the the asame if we superpose on both air and ball a cleating to this is to reduce the center of the ball; the effect of this is to reduce the center of the ball to rest, but to the size of the ball to rest, but to the ball as a wind moving and the six at rest, or better the ball is moving and the six at rest, or better the ball is a rest and the air moving. In lecture restrictions to take the ball at rest and the air moving. In lecture to take the ball at it is much more convenient to keep the ball atll and make the air move.

The first experiment I illustrate is one made by

The first experiment I illustrate is one made by Magnus in 1852; its object is to show that a rotating body moving relatively to the air is acted on by a force in the direction in which the nose of the body is moving relatively to its center; the direction of this force is thus at right angies both to the direction in which the center of the body is moving and also to the axis about which the body is spinsing. For this purpose a cylinder A (Fig. 7) is mounted on bearings about that it can be sun rapidly about a vertical axis; the cylinder is attached to one end of the beam is which is weighted at the other end, so that when the beam is suspended by a wire it takes up a horizontal mostilion.

"The beam yields readily to any horizontal force, so that if the cylinder is acted on by such a force this will be indicated by the motion of the beam. In front of the cylinder there is a pipe D, through which a rotating fan driven by an electric motor sends a blast of all which can be directed against the cylinder.

tric motor. An air-blast produced by a fan comes through the pipe R, and can be directed against the balls; the instrument is provided with an arrangement by which the supports of the axis carrying the balls can be raised or lowered so as to bring either the smooth or the bramble-marked ball opposite to the blast. The pressure is measured in the following way: LM are two tubes connected with the pressure of the axis of the conjust fit in between them; if the pressure of the axi on the side M of the balls is greater than that of the side J, the liquid on the right-hand side Q of the hand, the pressure at L is greater than that at M, the letthand side P of the gase will be depressed.

nand, the pressure at L is greater than that at M, the id-thand side P of the gase will be depressed not not include the control of the control of the pressure on the tree of the pressure on the two sides when the blast is directed against the balls; you see there is no motion of the liquid in the gase. Next I stop the blast and make the golf balls rotter; you see there is no motion in the gage. Now when the golf balls are spinning in the direction indicated in Fig. 9 I turn, on the blast, the liquid falls on the side Q of the gaze, rises on the other side. Now I pressure the direction of rotation of the balls, and you see the motion of the liquid in the gaze. Now I pressure the direction of rotation of the balls, and you see the motion of the liquid in the gaze is reversed, indicating that the high pressure has gone from one side to the other. You see that the pressure is higher on the side M. where the spin carries this side of the ball into the side M. where the spin carries this side of the ball into the side M. where me the spin carries of the side of the control when the side M. than the pressure is greated. The side of the correct when the table as the pressure is greated. The side of the correct when the fall is side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct when the fall is side and the side of the correct which the side of the side o

Self: as the eather from the dynamical point of view as where the air is still and the ball moves from left to right; hence we see that the pressure is greatest on the side where the spin makes the velocity through the air greater than it would be without spin.

THE SMOOTH BALL AND THE ROUGH

"To show the difference between the amonth hall and the rough ose, I bring the smooth ball opposite the blast; there is a difference between the levels of the liquid in the two arms of the gags. I now more the rough ball into the place previously occupied by the smooth one, and the difference of the levels is most han doubled, thereby showing that with the same spin and speed of air blast the difference of pressure for the rough ball is more than twice that for the smooth.

"We must now go on to consider why the pressure of the air on the two sides of the rotating ball should be different. The gist of the explanation was given by Newton nearly 180 years ago. Writing to Oldenburg in 1871 about the dispersion of light, he says, in the course of his latter: I remembered that I had often seen a tennis bell struck with an oblique racket describe such a curved time. For a circular as well as progressive motion being communicated to it by that stroke, its parts on that side where the motions consider motion that the stroke, its parts on that side where the motions consider motion that the stroke, its parts on that side where the motions consider motion that the stroke, its parts on that side where the motions consider motion that the contiguous air more violently, and there excite a reluctancy and reaction of air proportionately greater. The same explanation was given by Magnus, and the mathematical theory of the effect is given by Lord Rayleigh in his paper on The Irregular Flight of a Tennis #8ail; published in the Messenger of Mathematics, vol. vi. p. 16, 1877. Lord Rayleigh shows that the force on the ball resulting from this pressure difference is at right angles to the direction of motion of the ball multiplied by the webocity of sin, multiplied by the sine of the angle between the direction of motion of the ball and the vale of soil.

Let us consider a golf ball (Fig. 10) rotating in a current of air flowing past it. The air on the lower side of the ball will have its motion checked by the ro-tation of the ball, and will thus in the neighborhood of the ball move more slowly than it would do if there were no golf ball present, or than it would do if the golf ball were there but were not spinning. Thus if we consider a stream of air flowing along the channel PQ, its velocity when near the ball at Q must be less than its velocity when it started at P; there must, then, have been pressure acting against the motion of the air as it moved from P to Q, i. e., the pressure of the air at Q must be greater than at a place like P, which is me distance from the ball. Now let us consider the other side of the ball; here the spin tends to carry the ball in the direction of the blast of air; if the velocity of the surface of the ball is greater than that of the blast, the ball will increase the velocity of the blast on this side; and if the velocity of the ball is less than that of the blast though it will diminish the velocity of the air, it will not do so to so great an extent as on the other side of the ball. Thus the increase in presof the air at the top of the ball over that at P, if it exists at all, will be less than the increase in pres sure at the bottom of the ball. Thus the pressure at the bottom of the ball will be greater than that at the top, so that the ball will be acted on by a force tendmake it move upward.

"We have supposed here that the golf ball is at rest, and the air rushing past it from right to left; befores are just the same as if the air were at rest, and the golf ball rushing through it from left to right. As in Fig. 7, such a ball rotating in the direction shown in the figure will move upward, i. e, it will follow the rests.

SPINNING AND AIR PRESSURE.

The difference between the pressures on the two sides of the golf ball is proportional to the velocity of the ball multiplied by the velocity of the spin As the spin imparted to the ball by a club with a given lot is proportional to the velocity with which the ball leaves the club, the difference of pressure when the ball istars the club, the difference of pressure when the ball istars the velocity of the proportional to the square of its initial velocity. The difference between the average pressures on the two sides of the ball med only be about one-fifth of one per cent of the stimospheric pressure to produce a rore on the ball greater than its weight. The ball bawses the clab in a good drive with a velocity sufficient to produce far greater pressures than this. The consequence is that when the ball starts from the see spinning in the direction shown in Fig. 3—this is often called undersymb—the upward force due to the septiming in the direction shown in Fig. 3—this is often called undersymb—the upward force due to the spinning start of the consequence when the start of the consequence of the consequence when the start of the consequence of the consequence when the start of the consequence of the consequence when the consequenc

ing force may be many times the weight of the ball.
"The path of the golf ball takes very many interestas as the amount of spin changes. ing for trace all these changes in the arrangement which I have here, and which I might call an electric golf With this apparatus I can subject small parti cles to forces of exactly the same type as those which act on a spinning golf ball. These particles start from what may be called the tee A (Fig 11) This is a red-hot piece of platinum with a spot of barium oxide upon it; the platinum is connected with an electric battery which causes negatively electrified particles to fly off the barium and travel down the glass tube in which the platinum strip is contained; nearly all the air has been exhausted from this tube. These particles are luminous, so that the path they take is very easily observed. We have now got our golf balls off from the tee; we must now introduce a vertical force to act upon them to correspond to the force of gravity on the golf ball. This is easily done by the horizon tal plates BC, which are electrified by connecting them an electric battery; the upper one is electrific negatively, hence when one of these particles moves een the plates it is exposed to a constant do ward force, quite analogous to the weight of the ball w when the particles pass between the plate their path has the shape shown in Fig 12, this is the path of a basi without spin. I can imitate the effect of spin by exposing the particles while they are moving to magnetic force, for the theory of these particles we that when a magnetic force acts upon them it produces a mechanical force which is at right angles to the direction of motion of the particles, at right angles also to the magnetic force, and proportional to the product of the velocity of the particles, the mag-netic force, and the sine of the angle between them We have seen that the force acting on the golf ball is at angles to the direction in which it is moving at right angles to the axis of spin, and proportional to the product of the velocity of the ball, the velocity of and the sine of the angle between the velocity spin, and the sine of the angle between the version, and the axis of spin. Comparing these statements, you will see that the force on the particle is of the same type as that on the golf ball if the direction of the etic force is along the axis of spin and the magnitude of the force proportional to the velocity of spin, and thus if we watch the behavior of these particles when under the magnetic force we shall get an indication of the behavior of the spinning golf b Let us first consider the effect of underspin on the flight of the ball; in this case the ball is spinning, as in Fig. 3, about a horizontal axis at right angles to the direction of flight. To imitate this spin I must apply a horizontal magnetic force at right angles to the di rection of flight of the particles I can do this by means of the electromagnet. I will begin with a weak magnetic force, representing a small spin Observe how the path differs from the one when there was no force; the path, to begin with is flatter. though still concave, and the carry is greater than before—see Fig. 13a. I now increase the strength of the magnetic field, and the carry is still further in ed, Fig. 13b. I increase the spin still further, and the initial path becomes convex instead of con cave, with a still further increase in carry, Fig 14 Increasing the force still more, and the particle soars to a great height, then comes suddenly down, the carry now being less than in the previous case (Fig This is still a familiar type of the path of the golf bail. I now increase the magnetic force still further, and now we get a type of flight not to my knowledge ever observed in a golf ball, but which would be produced if we could put on more spin than we are able to do at present. There is a kink in the curve, and at one part of the path the particle is actually traelling backward (Fig. 16). increasing the magnetic force I get more kinks, and we have a type of drive which we have to leave to future generations of golfers to realize (Fig. 17).

"By increasing the strength of the magnetic field I can make the curvature so great that the particles fly back behind the tee, as in Fig. 18

"Though the kinks shown in Fig. 15 have nowe, no far as I am ware, been observed on a golf links it is quite easy to produce them if we me you'll link at it a quite easy to produce them if we me you'll link at it of the analysis of very whirt half and the same of the product of the kind used for toy balloons, filled with air, and weighing very little more than the sair if displaces, on attriking this with the hand, so as to put underspin month. It if describes a benefit on a to find the month.

upon it, it describes a loop, as in Fig. 16.
"Striking the ball so as to make it spin about a vertical axis, causes it to move off with a most exaggerated alice when its none is moving to the right looking at it from the tee, and with an equally pronumed multi when its most is moving to the left

agreered allow when its nose is moving to the right looking at it from the tea, and with an equally pronounced pull when its nose is moving to the left The general effect of wind upon the motion of a spinning ball can easily be deduced from the principles aiready discussed. Take, first, the case of a headwind. This wind increases the relative volcity of the ball with respect to the air; since the force due to the spin is proportional to this velocity, the wind increases this force, so that the effects due to spin are more pronounced when there is a head-wind than on a calinday. All golfers must have had only too many opportunities of noticing this.

"Let us now consider the effect of a cross-wind.

"Let us now consider the effect of a cross-wind. Suppose the wind is blowing from let to right, then, if the ball is pulled, it will be rotating in the direction shown is Fig. 1; he rules we found for the effect of rotation on the difference of pressure on the two sides of a ball in a blact of air show that in this case the pressure on the front half of the ball will be greater than that on the rear half, and thus tend to stop the inflict of the ball. If, however, the spin was that for silte, the pressure on the rear half would be greater than the pressure in front, so that the difference in pressure would tend to push on the ball and make it travel further than it otherwise would. The moral of this is that if the whol is coming from the left we should play up into the wind and siltee the ball, while if it is coming from the right we should play up into

HOW THE BALL GETS ITS SPIN.

"I have not space for more than a few words as to how the ball acquires the spin from the club. But if you grasp the principle that the action between the club and the hall depends only on their relative motion, and that it is the same whether we have the shall find and move the club or have the club flowd and project the ball against it, the main features are very easily understood.

"Suppose Fig. 20 represents the section of the head of a lofted thin moving horizontally forward from right to left, the effect of the impact will be the same as if the club were at rest and the ball were should assign it is horizontally from left to right. Evidently, however, in this case the ball would tend to roll up the fare, and would thus get spin about a horizontal axis in the direction shown in the figure; this is underspin, and produces the upward force which tends to increase the carry of the ball.

"Suppose, now, the face of the club is not square to

"Suppose, now, the face of the club is not square to its direction of motion, but that, looking down on the club, its line of motion, when it strikes the ball is along PQ (Fig 21), such a motion as would be produced if the arms were pulled in at the end of the stroke, the effect of the impact now will be the same as if the club were at reed and the ball projected along RS, the ball will endeavor to roll along the face away from the striker, it will spin in the direction shown in the figure about a vertical safe. This, as we have seen, is the spin which produces a silee. The same spin would be produced if the motion of the club were along LM and the face turned so as to be in the mostlion shown in Pic 22.

along LM and the face turned so as to be in the position shown in Fig 22, i c, heel in front of toe "If the motion and position of the club were as in Figs 23 and 24, instead of as in Figs 21 and 22, the same consideration would show that the spin would be that possessed by a pulled ball."

Nova Sagittarii, No. 3

THE following statement of the results of her observations is published in a circular issued by Harvard College Observatory by Miss Cannon, the discoverer of the new star "Nova 3" in Stagttarius

College Observatory or new against account of the new star "Nova 3". In Stagittarius "Nova Sagittarii, No. 3, was found while examining a plate sheen at Arequips on September 6th, 1889, will the one-fach Cooke lenn. As is customary with the writer when a new variable star is found, a number of photographs taken in different years were oxamined to determine something of the character of the variation. The pseudiar n-ture of the light curve was son vident. An examination was therefore made of a large number of photographs taken between turn 7th, 1889, and September 3rd, 1910. The object is visible on twenty-seven photographs taken and the star of the variation of the visible on twenty-seven August at a seven and the star of the visible on twenty-seven August 12 other and 13 other and 13 other and 13 other and 13 other and 14 other and 15 ot

seven in 1910
"Although no spectrum of this star was obtained, the suddenness of the outburst, and the form of the light curve, leave no doubt as to the character of the object. The star is not visible on photographs taken August 2th, 6th, 7th, and 8th, 1899. On the plate taken August 9th, 1899, G M T 14th 2tm an adjacent star of magnitude 11.4 is present but there is no trace of the Nova. The plate taken the next evening, August 19th, 1899, G M T, 12th, 25m, shows the new star at full brightness. On August 22rd, the magnitude was about the same, and it appears probable that it may have been brighter during the interval between August 19th and August 25th. The light faded rapidly at first but was nearly statonary and or magnitude 12th from Aprit to July, 1809. It then

decreased slowly, and was magnitude 18.3 on October 3rd, 1901. Since that time, it has not been seen, un we assume that the faint object on the Bruce plates is identical with the Nova

What Produces the Aurora Borealis?

A VERY interesting paper on this subject was read before the Congress of Mathematics at Rome by Prof C Stoermer We quote here the most essen tial parts of his lecture

6 Birkeland discovered that cathode rays a attracted and converged toward the pole of a very powerful magnet (Fig 1). This result, which, as Poincaré has



Fig. 1. - Cathode rays converged

shown, is in perfect accordance with the mathematical theory the motion of an electric corpuscie in a magnetic field, led Birkeland to form a fertile theory of the origin of the au-rora borealis. In the same Birkeland, after citing Paulsen's hypothesis that the aurora borealis is due to phosphores cence of the air rays coming from

pheric strata, announced his conclusion that these rays originate outside the atmosphere, are produced in some way by the sun, and are absorbed principally at the terrestrial magnetic pole

Birkeland has since conducted three expeditions to the Arctic for the purpose of studying the aurora and the magnetic perturbations, and has performed some remarkable experiments which give support to his

theory
"Fig. 2 illustrates an experiment in which a mag-

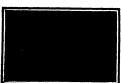


Fig. 2. Magnetic sphere in cathode rava.

netized sphere, representing the earth, and coated with phosphorescent barium platino-cyanide, became surrounded with a luminous ring when it was sus-pended in a stream of cathode rays. With a very small and very highly magnetized sphere, two lumi-nous rings, encircling the magnetic poles and corresponding to the belts of maximum frequency of auroras, were obtained (Fig 3). "Stoermer has developed the mathematical theory

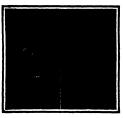


Fig. 3. -- Strongly magnetized sphere surrounded by two ous rings in cathode rays.

of this phenomenon, and, in a series of researches ex-tended over four years and involving more than 5, 600 hours of actual computation by himself and his assistants, has obtained results which explain the principal phenomena observed by Birkeland and many of the characteristic features of auroras and magnetic perturbations.

ermer's task consisted essentially in dete ing, from the known laws governing the motion of a

cathode particle in a magnetic field, the trajecto of electric corpuscies emanating from the affected by the earth, regarded as an elemen es emanating from the ann, as affected by the earth, regarded as an elementary mea-net. A model representing a bundle of such trajec-tories, or rays, is shown in Fig. 4.

"The particles, deflected from their restilinear course by the earth's magnetic influence, sweep

course by the earth's magnetic influence, sweep round the earth and strike it, or its atmosphere, in



Fig. 4.-Model representing cathode rays deflected by

almost every part of a ring encircling the pole. This explains the production of auroras at night when the sun is on the opposite side of the earth. In general, the paths of the particles are not plane curves, but are curves of three dimensions, as appears more clearly from the model shown in Fig. 5. Owing to the com-parative smallness of the earth and the fact that the sun's angular distance from the terrestrial magnetic equator never exceeds 35 deg., only those par-ticles that are projected from the sun, at any given time, in or approximately in certain definite direc tions, reach the earth or its atmosphere. Hence the theoretical suroral zones are limited to rings encircling the earth's magnetic poles, in positions which closely correspond to the observed belts of maximum frequency of

Let us now consider a very narrow pencil of cathode or cal rays emanating from a single point of the sun in directions nearly parallel to one of the definite directions men-rays deflected by the expression of the control of the contro

enting cathode

abor The theory shows that these rays, after entering the earth's atmosphere, will form helices about a line of magnetic force. The result will be a typical suroral "ray" or "streamer," the thickness of which will vary, according to the character of the original solar rays, from a few yards for cathode rays to several miles for the Alpha rays of radium.

"If the point of emanation of the solar rays is shifted slightly, the resultant auroral ray will be shifted correspondingly, and its displacement can be shifted correspondingly, and its displacement can be calculated from the mathematical theory. Hence it is possible to determine by calculation the entire region of the atmosphere that is hit by corpuscles emanating from any given area of the sun's surface.



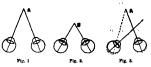
Fig. 6. - Auroral drapories.

result gives a very natural explanation of the perulis and beautiful phenomena called auroral draps which are illustrated in Fig. 6. The calculation of that for certain positions of the emanating surface with respect to the magnetic axis a pencil of rape of originally circular cross section is emersionally axis tended, in a direction perpendicular to the ma atmosphere it forms a very wide and thin short of auroral drayery. For example, in a special case, it which the emanating surface is assumed to extend 3 minutes of an are parallel to the sarth's a

rays, the drapery to 170 miles wide and 200 lest thick. The theory also suplains the remarkable plus of multiple draperies, illustrated in Fig. 6."

The Cause of Squint

T is a matter of common knowledge that the affec-tion of sight popularly described as a equint, and technically term "strabiamus," can from remedied by surgical measures. It is also fairly known that the operation does not always give such complete success as might be desired. The under-lying reason for the occasional failures, and the entire sie of the medical and surgical treatment of the disorder, are, however, less generally understo disorder, are, however, less generally understood. The subject has been luckly discussed by Prof. Bisi-schowski in Die Ussechous. Strablamus may have its cause in a variety of circumstances, and the treatment proper for one case may be quite undehyded to an-other. The matter is stupiette when the ease of the trouble is purely mechanical, and resides in the muscles of the cybell, which are subnormal in their relative development. These are the cases readily amenable to surgical treatment, and if failure results from an operation in a simple case of this kind, it may be due to lack of skill on the part of the surgeen. But strabismus may occur through entirely different When we fix our gaze upon any con near object, our eyes must undergo two adjustments. First so-called "accommodation" is called into play, whereby the lens of the eye is modified to correspond to the distance of the object from the eyes or that a sharply focused image is formed upon the ruiter. But at the same time it is necessary for the two eyes to assume the right position of "convergence," such that the two images of the object looked at may apn corresponding portions of the retina of right and the left eye. Now the nervous mechanism right and the set eye. Now the nervous secondarians which controls these adjustments is such that there is a direct relation between the two actions. Hence if a person's accommodation is abnormal, as in farsighted or short-sighted individuals, a condition of



riewing a near o rately distr

accommodation which should normally be associated with comparatively high convergence, as in looking at a near object, now becomes necessary in viewing an object at a far distance. The result is that the eyes are made to converge as if they were viewing a near object, or in other words there is an inward squint produced. These relations are most readily understood by reference to the accompanying diagram.

A person with normal sight, fixing his gaze on some object A (Fig. 1) receives upon corresponding portions of the retinas of his two eyes a clear tions of the retinas of his two eyes a clear image of A. The conditions are much the same when he views a mar object B, sxcept that now the axes of his eyes converge more closely (Fig. 2). A far-sighted person, bowwer, looking at A (Fig. 3) has to accommodate his lenses to the same extent as the normal eye in looking at B. With this strong accommodation effort there is associated such a high convergence of the axes of the eyes, that he can view A only with one eye, while the other eye necessarily looks across-the line of vision of the first; there is a conview moduced and the invesses the vision of the first; there is a squint produced, and the images on the retinas of the two eyes do not properly correspond. It is quite obvious that surgical intervention, which consists in kening the pull of certain of the muscles, is quite out of place here. Such an operation may for a time in maure remedy the inward aquiut accompanying viewing of a near-by object, but will tend to

the viewing of a nearby object, but will tend to introduce in its place an outward seguint under ordi-nary conditions. The remedy would be worse than the disease. The proper treatment in such a case in the prescribe proper overglasses for the patient. There is a third type of terrblamms, which is this to maryous disorders. Here also surgical treatment swipth the quite out of place, and, if applied, may lead to view undestrable and unpleasant results, which, if if these, can assuring to rectified by a second operation of the place of the confidence of the confidence in the manual properties of the second operation in the first median devisor.

and the patient has not lot as the medical advisor.

The subject presents some subject or and the patient who values the expetit to put his case into the hands of a distant physician.

An Electric Recording Rifle Range Target

By the English Correspondent of the Scientific American

Military circles in Europe have been recently deapy interested in a new electric recording target suitable for rifle ranges, that has been perfected by an Australian inventor, Mr. S. A. M. Rose, with which demonstrations were recently carried out in London. The remarkable strides that have been made in the range and speed of firing in service of rifles have



Scenic recording target for maving objects. Bull's eye

necessitated an improved form of target and better methods for recording the shots. To this end several automatically recording targets have been devised, but they have not proved completely satisfactory, it having been found impossible to indicate with the requisite accuracy the precise location of every shot hole in the target. In this direction the new apparatus is a distinct improvement, for it gives infallibly the hactual point where the shot has hit the target, and where extremely accurate shooting is demanded, has proved far superior to any system yet devised.

The apparatus can be applied with equal facility to any desired range, whether it be an indoor range where infiniture rifles are used, or an outdoor range varying from 25 to 2,000 yards. It can be used either with a stationary built eye target or with a moving target. In this latter instance its utility is enhanced,

inasmuch as it not only shows the "hita," but the "missee" as well, so that a reliable idea of a rifeman's marksmanship can be instantly determined. Simplicity is another outstanding feature, only three wires being necessary.

The accompanying illustrations evilain the design and operation of the apparatus. The object target shown comprises a frame at the back of which are set up vertical rollers carrying a form of the many set to the other. The front of the frame is sheathed with armor plate having a square opeaing which leaves the paper exposed. A section of paper is run across this space for each shot in ordinary builts eve firing, being wound up on the second roller atter each round.

The hole B in the diagram is caused by the passage of the bullet through the paper. In the course of being wound up the paper passes under a row of contact ingers F, and the porteration permits one or more of the fingers to drop through, making contagt. The electric circuit thus established immediately disconnects a clutch O, which stops the rollers, and the position of the bullet hale is instantly indicated on the reproducer located beside the markemma at the string line. He can thus hencalty ascertain the effect of

thus instantly accordant this shot. The reproducer is a transparent respitue of the object target, having behind a permanent magnet military permanent. By the pointer of which, R. derries on the tip of a small white slike representing the bullet hole. When the control of the

the object target. Small electric motors serve to operate the rollers, and on short-range targets this movement is mechanically transmitted, on a reduced scale, to the carriage of the pointer in the indicator. the pointer moving horizontally across the face of the reproducer at a speed, and for a distance, corresponding to the movement of the paper perforated by sponding to the investment of the paper perforated by the bullet across the face of the object target. This gives the horizontal position of the bullet hole on either side of the bull's sys. The vertical position of estage stage of the built significant of the built hole is determined by the vertical row of fingers F, as already explained. The fingers are set close together like the teeth of a comb, and when making a contact through the built hole, establish a circuit, through a small continuous resistance, which varies according to the position of the finger, as the apparatus is calibrated, each successive finger being sected to a higher resistance than the one immediately below. The result is that the pointer on the indicator is moved vertically, and reproduces the correct elevation of the bullet hole on the target relative to the bull's eye. This ingenious combination of horizontal mechanical and vertical electrical movements insures the possibility of giving two hundred position indications per square inch

If a card is placed in front of the object target, and a transparent facsimils in a corresponding position in front of the reproducer, accurate indications of the hits are secured. In such cases the object target he stationary. This is the practice generally adopted; but if the object be printed on the paper of the target, the latter can be fired at while in motion, and the hit be faithfully shown on the reproducer. Lifetime conditions can be reproduced by depicting a scenic view across which the figure of a man or other object printed on the moving paper is caused to move, there being an aperture in the outer covering through which the moving object can be seen. On the indicator screen a facsimile of the man is provided, and the results of the shots fired at the moving target are indicated on the preproducer, as well as all "misses"—chospiels information as to his skill which the marksman has hitherto been unable to obtain.

The roll of apper is punched at requirar intervals.

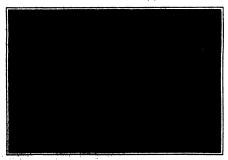
The roll of paper is punched at regular intervals with gage marks, through which contact is made to bring the machine at rest and return the pointer of the reproducer to "sero."

In the diagram the pointer is in the gage hole, and the current is flowing from the + main through the lamp L, illuminating the reproducer, and



The reproducer placed besidthe marksman.

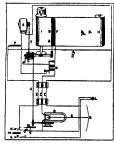
Rear view of target, showing paper rolls.



Shooting gallery fitted with targets recording the hits adjacent to the marksmen.

THE ANNUNCATOR APPLIED TO TARGET PRACTICE

the adjustable potentiameter M to earth, and in parallel with this, going to earth through the counter finger F, it passes through the reproducer D to the cutout N, which cuts off the current from the mag netic driving clutch C. If the short-directling key O be pressed, the current is cut off from the cutout, and the armature returning, establishes the clutch circuit,



Arrangement of target apparatus and reproducer.

starting the mechanism and removing the perforation from the contact finger F, after which the key may released, and if no abot has been fired, the machine runs until the next gage hole is reached, by which time the pointer of the indicator has traveled across the reproducer acreen, released itself, and has returned automatically to sero. A short is fired, the short-directiving key is depressed momentarily, and the machine immediately start up, the paper traveling until the builet hole comes beneath the contact fingers. Another pressure of the short-directiviting key causes the paper to continue its travel until brought to a stop by the next gage hole.

To start the apparatus, it is only necessary to insert a plug in a lamp socket and then to switch on. There is a shunt P across the clutch coil; R is the target illuminating lamp, S the motor driving the

paper, H the reserve roll of the paper,
I the speed roller from which the speed
of the traveling paper and pointer of the
reproducer are controlled, K the receiving roller for used paper, EIII' counecting wires, U a belt driving the reproducer mechanism, and V a silding
contact maker to adjust the voltage of
the reproducer circuit. The target can
be instantly changed from dummy
buil's eye to motion working, since the
card is carried on a rod, and can be
turned down out of the way for moving
target firing. The used paper can be retained as a permanent record, such as
of shooting competitions, and in case of
dispute the results of firing can be
easily checked or investigated

The applications of the system are possible through a very extensive field. In long-range use the horisontal movement of the polarier on the reproducer is electrical, and the expense of a marker would be saved. The apparation, the liability of breakdown remote, and the operating cost, confined to current and paper, of a trifling character. Military experts who have seen the apparation in practical use in England have copressed complete satisfaction with the infallible accuracy it provides

Oil-Cement Concrete

A N important investigative work during last year was the development of an oll-comment concete, and from results obtained the experiments indicattant it would be practical to use this material for floors, cellars, foundation walls, tanks, allos, manure pits, and simlifar ponstruction, where strength, and ldity, and waterproof qualities are re

[The Editor of the Home La estions for this department vailable.]

Experiments on Light By Sydney W. Ashe

A MC UNDER WATER.—An attractive experiment performed in a darkened room is that of making an are under water Two carbon electrodes are used, one a rod, the other a piece of flat carbon, which may rest in the bottom of the dish. The dish is filled with water, and a circuit formed consisting of a 120-volt direct-cur-



rent source of supply, the carb rod as positive electrode in series with an adjustable resist once, and the submerged flat carbon electrode connected to the negative source. Upon bringing the electrodes together

and then separating them, an arc will be formed for an instant Care should be taken not to allow the are to be formed too long, or it may break the

glass receptacle glass receptacie.

Principle of the Oil Switch.—If kerosene oil be substituted for water in the previous experiment, the arc will be quickly extinguished as soon as it tends to are will be quickly extinguisace as soon as it cents to form. For this reason, this principle of the oil ox tinguishing the are is used to advantage in modern oil switches used in central station operation High-potential currents of several thousand kilowatts may be interrupted in a small compartment, due to the smothering action of the oil, which occurs when the



alternating current is passing through zero. Where the same thing is attempted in air with an air switch,

Fig. 2.—Experiment in visual acuity. mes 13 feet in length are formed when the air switch is opened.

FECT OF A FOREIGN LIGHT IN THE FIELD OF VINION -The effect of a foreign light in the field of vision or visual scuity may be readily shown by means of a home-made Mellen's chart. A Mellen's chart is one containing a large number of letters in different rows, containing letters slightly larger than the previous one. Opposite each row of letters is plan number, which indicates the distance at which the normal eye should be able to distinguish the series of Cut from an old calender or a magazine s series of letters of various sizes, and mount them upon a white card with an unglazed finish Fasten the card to the wall in a darkened room, and place a candle on a table with the same height as the letters, so that it

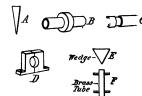
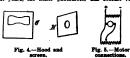


Fig. 3.-- Elements of a flicker r

can be moved at various distances from the letters. This will vary the intensity of the illumination upon the letters, the intensity varying inversely as the square of the distance. When the candle is 1 foot from square of the distance. When the cancile is 1 foot from the letters, the illumination will be 1 foot candle, when it is 2 feet, the illumination will be 1/2° or 1/4° of a foot candle. The candle-power divided by the dis-tance squared gives the illuminating value. The candle tence squared gives the intuminating value. In each should have a black card placed behind it, so that the lights@fill be acreened from the eye of the observer. To one side of the chart is placed another candle, unsereened, which may be used when occasion aries. With the standard candle placed at 1.5oot from the

chart in a darkened room, the of ally approach the chart until he is able to just dis-tinguish the letter. This final distance of the observer from the chart should be noted, and the experiment from the chart should be noted, and the experiment repeated about ten times, and the average distance from the screen noted. The observer should remain in the room about fifteen minutes before taking observations, so that the eye will have sufficient time to become accommodated. The foreign light to one side of the chart, about 1 foot's distance, placed so that it will not add additional illumination to the chart, should then he lighted, and the experiment repeated. It will be found that it is necessary for the observer to ap-proach the chart much closer in order to be able to read the same letter with the standard candle placed at the same distance. The foreign light in the field of vision decreases the observer's ability to read about 35 per cent.

How to Build a Flicker Photometer.-cent years, the ficker photometer has be



nized as the standard method of comparing lights d fering in color. Such a photometer is quite easy to build. Procure from an oculista 10-deg. glass prism, A, Fig. 3. This will cost from 30 to 60 cents. Mount this prism in the end of a 1/2-inch brass tube B, 2 inches long, and mount a small pulley on the tube. The tube should then be supported in two bearings D, so that it can be rotated If a lathe is handy, a groove C may be let in the tube in two places, and mounted in two supports D, as in the illustrations. A small disphragm containing a $\frac{1}{2}$ -inch hole should be mounted in the opposite end of the rotating tube. A plaster of Paris wedge E of 60 deg. should then be made, or it may be made from thin pieces of board. The point of this wedge may be mounted opposite one end of tha brass tube—the end containing the 10-deg. prism. This whole apparatus may be mounted in a light-tigh containing two apertures, opposite which are placed the two lights to be compared. The observer places one eye in line with the rotating prism, so that he can look through the tube, and see first one side of the wedge and then the other as the prism turns. The observer's eyes may be shielded from foreign light by means of a hood G of leather, which is fastened to the photometer box. Two light acreens H should be mounted opposite each of the circular openings in the mounted opposite each or the circular openings in the box, so as to screen off any reflected light. The rotat-ing tube may be driven by any form of motive power. If a small shunt motor is used, operating on a direct-current source of supply, the field may be connected directly to the source of supply, and the armsture



shunted from a series resistance, which is conne directly across the mains. This produces a variable speed of quite a large range. One of the lamps to be compared is a standard lamp, which is fixed at a given compared is a standard samp, which is fixed at a given distance, say 100 centimeters, from the photometer box opposite one of the openings. The other lamp should be movable, and attached to a sliding stick. Opposite the center of the photometer box should be Opposite the center of the photometer box should be a spring contact point. Pressing this point down when a balance is made will punch a small hole in a paper fusience to the movable rod. Ten settings should be made, and the median point located. In locating the median point, count from sither the right or the left, and mark an arrow between the fifth and the sixth point. Remove the thumb tacks, and then insert another piece of paper in position. To operate the photometer, see that the standard lamp and the lamp under test are operating upon a constant voltage of the required value. Place the standard lamp is a dislance of 100 centimeters from the riskoncepts seen. and start the motor operating, which will rotate the photometer sero, and start the motor operating, which will rotate the photometer observation tube. If the speed be very photometer observation tube. If the speed he very slow, and if the two lamps are illuminating the wedge with different intensities, the observer will see first non-circular field of one intensity and then is monther circular field of another intensity. At their insofting circular field of another intensity. Where two lighten of different color, such as a bine and a green, are being compared, the observer will see first a green should be increased until about seven lightens a sound field and then a red field. The speed of the rigiger should be increased until short seven lightens a sound are perceivable. The movelable red should them be di-found until the fitcher disappears. When this adjustment has been made a belie should be purposed in the paper on the movebble red. If the motor question the

opened so that the tube may be rotated by turning this belt, it is possible to turn the tube so that both either the possible to turn the tube so that both either of the plaster of Paris wedge are visible at the misse time. Adjustments may then be made, using the photometer as a equality of brightness photomisets. If a wedge of wood is used, pleces of print may be mounted upon each ride, and the movable bar adjusted until the type may be read with the same clearness on both sides. With these various arrangements of the photometer, it is possible to compare the three principal methods of comparing light intensities—the fisher is of comparing light intensities method, the direct comparison method, and the equity method. It will be interesting in this connection to metad. It will be interesting in this donnection of note two things—first, that the median of the readings for each method will not of coincide, and second, with the flicker method the individual readings will be

A Simple and Adaptable Form of Electrical Contact

By W. P. White

N ninety-nine cases out of a hundred, the most effective electrical contact is one where the presenter is given by a spring. In eighty-nine cases, perhaps, out of a hundred, the most convenient electrical contact also can be obtained by the use of a spring. The familiar binding post is an admirable device; The familiar binding post is an admirable device; it is simple, cheap, and compact; but it has disadvantages. For instance, as a rule, any one binding post will seldom hold all size of vire. Binding posts often tend to break or deform the wires which are apt to work loose from binding posts, so that considerable vigitance is often required to prevent errors from loose contacts. Another disadvantage is the loss of time where contacts have to be often changed or readjusted. If a device can be found which permits contacts to be made by a single motion, and mits contacts to be made by a single motion, and at the same time has in other respects the main advantages of the binding post, the binding post would certainly be inferior in comparison.

Such a contact is possible; it is free from all the disadvantages, above disadvantages, and is actually cheaper than the binding post. It can easily be made of a strip



or tougue of thin sheet copper (or brass) inserted into one of the common wooden spring clothespins. lato one of the common wooden spring ciothespina, as in the accompanying engraving. The resulting "clamp contact" will take hold or let go instantly, and yet, if desired, it will hold indefinitely without danger of imperfect contact. It will hold anything, fine or coarse, round, flat, or irregular, that is not too big to enter its jaws. It costs less than half a cost, and calls for no other tool than a pair of

But while this device should prove a boon to the electrician who is cultivating his subject on slender financial resources, it is anything but a toy. It allows both contact pieces to be made of soft copper, so that, if copper wires are employed, as usual, no different metal is introduced into the circuit by the contact. This favors freedom from thermo-electric electromotive forces; moreover, such freedom is also favored by having the contact made between thin strips of metal, which quickly come to a common temperature. As a result, this form of connector is rapidly coming into use in the most delicate and refined measure-

resistance of such a contact is surprisingly low (0.0002 ohm when clean, or about the same as in the Sest dial switches); of course, some atten-tion must be given to cleanliness, but no more than

tion must be given to cleanliness, but no more tunn with most other types of contact

If two copper strips, separated by a wider strip of ceiluid, are showed into the same clamp, a two-pole centact is obtained. This can be quickly clamped on a two-pole contact point made of two characteristics access string similarly amagential by clamped on a two-pole contact point made of two other similar copper strips similarly separated by sheet celluloid. If the leads are not too stiff and-short, the whole can easily be used as a commutator, without any further alteration. Connections are reversed by simply turning the clamp through 186 dag. An even quicker communicator can be second by a night-change in the contact point, which now contact, which now contact, with the Cubanged pieces of absect coping. These pass, shrough the colluloid, so that the strip which is higher the colluloid at one and be betted if at the other, and conversely; the communication then requires mercury stiding the ulamp along. If you clamps are fastened together, also by diving the pass to succeed the control of the control versed by simply turning the clamp through 186

tion to the clamp. This can be avoided (for instance) gle contact by arranging to clamp a single, per strip so as to join two stationary strips,

The state of the s

which are insulated from each other by celluloid.

The electrespin contact has been used to give a anda arrangement for inserting one ammeter succonsively into several different circuits without interrupting current. At the point where the insertion is to be made, two copper strips run down into the clamp, insulated from each other by celluloid except at the end, where they are usually in contact, closing the circuit. The ammeter leads terminate in two copper strips, which run on the opposite sides of a wooden wedge. When this wedge is forced into the jaws of any one of the clamps, the original contact there is broken, but not till after the ammeter is ted to both sides of the break, so that the current is not interrupted.

A Magnetic Snake By Chancy W. Niems

A VERY interesting and beautiful experiment for the home laboratory, and one which shows in a very striking way the relation between electricity and magnetism, is the magnetic snake. All the preparation necessary for this experiment is a bar magn a few batteries of any form, and a small amount of very simple construction.

It is made as follows: A few strands of tinsel,



such as is so much in evi-dence at Christmas time. are braided together to a very flexible electric co ductor, as shown clearly in the accompanying illus tention. The ends are attached to two screw eyes, which are screwed into the wooden support. A bar magnet is fixed by its mid-die as shown. Wires from a few dry cells are con-nected to the two screw eves. It is best to have a reversing switch, so that the direction of the current through the tinsel can be changed. When the current is turned on, the "snake" will act like a live bos constrictor, coiling it-self with great suddenness and velocity around the unsuspecting bar magnet Upon reversing the current it will quickly uncoil itself.

and writhe around until it ig tightly wrapped up in the opposite direction. If the magnet is not painted about the middle, a layer paper should be put around it to keep it from shortiting the tinsel.

The direction in which the snake wraps its the same as that in which a piece of wire would have to be wrapped to make an electro-magnet with the noise at the same ends as the noise of the har magnet.

How to Make an Insulated Thumbscrew

TAKE a small pill-box, the size of the required head. Fill it with hot sealing wax (black preferred), then while still soft, place the head of the bolt or screw in it, and allow it to cool A piece of bent tin may first be soldered to the head of the bolt to give the wax a good grip. When cool, the paper box may be washed off and the wax touched up with a hot knife blade Milling may be put around the edge in

A Sensitive Relay for Wireless Telegraphy By E. H. Williamson, Jr.

T is probable that the majority of amateur wireless telegraphers are in the habit of sitting by their re-catving apparatus with the telephone receivers over their sars waiting for the buss which indicates that "some cars watting to the buss with introduce that state thing, is coming in from the serial. It is also probable that many of them have gotten very tired of sitting there listening for long periods and have removed the slient 'phones just as a message has started to come in. Being in this class myself. I started experimenting to see if there was not some method by which the incom-ing Hertsian wave would either register itself, or at at give a signal which would be audible without the sessity of keeping the 'phones to the ears. Several intensity of keeping the phones to the ears. Several feriodes were tried without success, and finally the one isserthed in this article was built, which gave a rea-manble degree of satisfaction when carefully adjusted "The principle involved was very simple, namely, to knowns the minute motion of the telephone receiver the minute principle of the principle of the control of the simple principle of the principl

could be closed and broken simultaneously with the

could be closed and broken simultaneously with the movement of the diaphragm.

The relay was made as follows. A hard wood base eight inches long by three inches wide, was made, these dimensions being convenient but not necessarily to be adhered to. Across the ends two string were watch case" double pole telephone receiver was wound to about 250 ohms resistance with No. 38 S S.C. copper This was set at the right-hand side of the be one inch from the end, the ring projecting from the receiver being clamped between two strips of wood through which a screw was driven into the base, holding the receiver immovable. A strip of one-sixteenth of an inch brass one-half of an inch wide and three and one-half inches long was bent over for one inch, at right angles and a U-shaped strip of thinner brass soldered to the bent arm so as to project downward A notch was then filed centrally at the bottom of es log of the U, and the standard was screwed vertically at the end of the base board. The photograph shows the idea clearly. A lever arm was made from a piece of three-sixteenths of an inch square brass three inches long, a long thin brass pin being soldered across one end, so as to rest in the notches of the U, to form a pivot for the lever. This bar was drilled and tapped for a 4-32 machine screw at point one and one-half inches from the p that the screw would be over the center of the diaphragm. A one-inch machine screw was then driven through the square bar until it rested on the disphragm, and held the lever parallel with the base piece of No. 1 copper wire eight inches long was then soldered to the left-hand end of the bar, making the total length eleven inches. disphragm was of course multiplied at the end of this lever, but not sufficiently, nor steadily enough to depend on for a make and break of contacts, so a second lever, also of copper wire, No. 41, six inches long, was pivoted on a U-shaped support, of brass, screwed to the base. The left end of this lever was bent at right angles and so adjusted as to rest with a slight weight against the lower surface of the first lever, the cross arm pivot being set two-thirds of way toward the left end for this purpose, and also to multiply the movement further. At the right end of the second lever, a short brass strip was soldered. provided with a machine screw and which was clamped a piece of

No. 22 platinum wire pointing upward. A brass block with a similar strip and screw project-ing from the left side was screwed to the base in such a manner that the left side could be raised and lowered a trifle, A bit of platinum foil was clamped to this support by the screw and washer and the right end of the second lever bent up until the platinum wire was about one-sixteenth of an inch below the foll. This distance was again reduced by unscrew ing the machine screw in the bar about one turn, thus drop ping the first lever and raising the opposite end of the second The final adjustment was made

by lowering one side of the contact block until the two contacts were almost touching. The terminals of the telephone receiver were connected with two sts at the right. The posts at the left connected the contact block and the U support of the second lever. The receiver was put in circuit with a home-made silicon detector, shown at the right, the serial and ground wires being connected as usual relay posts a local circuit was run to a battery and home-made telegraph relay of 200 ohms reststance. When the armsture of this relay was finely adjusted close to the magnets, it would vibrate with a sound quite audible in any part of the room when the telephone receiver diaphragm moved under the influence of a wave from the serial

I tried connecting a single stroke electric bell to the terminals of the second relay and got a sound out of it, but it was no better than that of the relay alone, so I abandoned this plan.

The first contacts in the relay were made with mer-cury and platinum, but did not work, as the capillary attraction of the mercury prevented a break when a contact was once made. The wiring chart gives a clear idea of the various circuits and their connections.

Concrete Cathedral

THE cathedral of Poti on the Black Sea in Russia is built entirely of reinforced concrete. It is of the Byzantine type, designed somewhat after the St. Sophia structure of Constantinople. As the loose song structure of Constantinople. As the loose sandy soil near the Rion River, upon which the build-

ing is located, will admit of but little weight on the pile foundation, reinforced concrete answered the purpose very well, and it took less than a year to build. against ten years for the Batoum and other Russian cathedrals, besides costing much less It has a main dome surrounded by half-domes covered with sheet irou A pressure of but twenty pounds per square inch was permitted upon the foundations

Colored Shadows

By Prof. Gustave Michaud, Costa Rica State College NOT many people are ready to admit that a dead black, opaque, object may cast, in special circumstances, a beautifully colored shadow upon a white surface, yet the fact can be shown in less than five

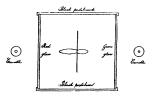


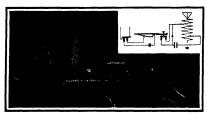
Fig. 1.—Plan view of box for producing colored shadows



Fig. 2.-Front view of butterfly fran

minutes wherever two candles, a sheet of black paste-board, and two pieces of colored glass (red and green) are at hand

With these implements a parallelopipedic box is erected upon a sheet of white paper, the top of the box being left open Fig. 1 is a top view of box show



A sensitive relay for wireless telegraphy.

ing the arrangement of the four pieces of glass and pasteboard. A piece of black paper is then cut to about the shape

shown on Fig 2, and glued across a small piece pasteboard Fig. 2 is a front view of the whole A top pasteboard Fig. 2 is a front view of the whole A top view is seen in the center of Fig. 1. The candless are placed as shown in Fig. 1, and every light but two candles being extinguished, it becomes evident two the paper bottom of the box remains as white as before in spite of the fact that colored light only now falls upon it The vertical piece of black paper is now laid

on the center of the box in the position in Fig 1
The result is a beautiful butterfly which appe which appear on the white paper. Its posterior pair of wings is intensely red; the anterior pair is of a pure green White disks are seen on the corner of each

wings are but the shadows of the vertical piece of black paper, deposited in the middle of the box, and the reason why an opaque object may, in such circumstances, cast a colored shadow on a white surface lies in the fact that red and green lights complementary and give white light wherever they fall together. On the other hand, wherever the opaque object intercepts the green light only, the paper re mains red, and, similarly, wherever a shadow is cast for the red light only, the paper will be green

If, instead of being placed so as to cast a shadow for one color only, the black paper intercepted both of them together, the result would of course be the ordi-nary dark and colorless shadow.



The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting



My Days With Edison By Edward G. Ache

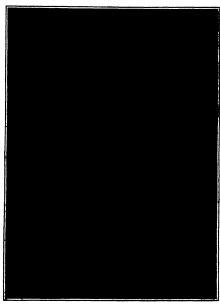
N the autumn of 1880 I decided to cast my lot in the East. Edison and his laboratory at Menlo Park were then much in the public eye. I had little hope of securing an opening there, but as a desperate, final resort, took the train out to Menlo Park. I climbed the low hill from the station and entered a small brick building in the corner of a large fenced inclosure. The building con-tained the office down stairs and Edison's library up stairs. I handed my card to a boy in the office with the re-quest to see Mr Edison. He took the card and disappeared; presently returning, he opened a small wicket gate, and inviting me to enter, conducted me out of a rear entrance of the office, across a vacant lot, and into a long two-story frame building. He took me up stairs and into a room covering the entire second floor containing a number of long pine tables, the walls being lined with shelves holding bottles. At one of the tables sat three men, the center one in a colored calico shirt, without coat, was introduced as Mr. Edison introduced as Mr. Edison The one on his left I knew afterward to be Mr. Will-J. Hammer, and the one on the right as Mr. Francis R. Upton. Mr. Edison placing one hand to his ear to indicate I should speak loudly, asked, "What do you wish?" I replied, "Work." He re-plied, with perhaps impatience, "Go out to the machine shop and see Krussi," and returned to the work absorbing his attention. Mr. Hammer kindly told me to go down stairs, pass back through the laboratory, cross the yard to a one-story brick building, and Krussi, who was the superintendent.

I followed Mr. Hammer's directions, and entering the machine shop, found myself in a small office, almost com-pletely filled with a large draughting table, over which a man was working. An attendant received my inquiry for Mr. Krussi, and while he was gone I was very busy preparing myself, loading my gun, so to speak. The draughting table inspired me. I had had some expe using the tools of a draughtsman in my civil engineering work foreign-looking gentleman entered and asked me what I wanted This was Mr This was Mr On the spur of the moment I am afraid I told a white lie I replied. "Mr. Edison sent me to you for you to put me to work" "What kind of work?" he asked "Draughting," I said. "All right," he replied "Mr Hornig needs an assistant Can you report for duty Monday morning?" I assured him I So it happened that the 12th day September, 1880, while still in my twenty-fifth year, saw me installed in employ at Menlo Park, N Mr Krussi soon learned of the decenunder suspicion for a long time

Menlo Park, in the fall of 1880, was composed almost entirely of Edison's in-There was the Pennsylvania Railroad station, a hotel, at which I boarded, the homes of Mr Edson, Charles Batchelor, and Francis Upton, three or four boarding houses. Edison's laboratory, office, machine shop, and a ject of perfecting a small dynamo I had just to Mr. Hornig to the draughting, room under my supervision the necessary iron castings made at more special work in which Mr. Samuel Newark, and with the help of a co-D. Mott was principal daughtsman. worker, Martin Force, to set the tools in the lathe, I worked in the machine shop

made long ago I found it so faulty that room devoted to making the drawings I concluded to build a new one. I had for Mr. Edison's patent applications and

Mr. Edison was at this time working upon an electric meter to be used in at hight, where I was permitted the use connection with central station distribu-of the tools Mr. Edison several times tion. I became acquainted with the re-stopped at the lathe at which I was work quirements of the case and the urgent and watched me intently. I pre- need of such an instrument.



EDWARD G. ACHESON

sume he had forgotten me and had to in- peared to be a happy thought occurred renowned by reason of his great tele-graph inventions. The world was at tric incandescent lighting. After I had been at Menlo Park long enough to feel on them, and at home, I showed Edison the small in thought. dynamo I had made at Bradford and asked his opinion of the ideas involved He said it was sike the one designed by

quire who I was. Edison was then but to me for the method and design of a thirty-three years of age, although world-meter. I made a drawing of my proposed instrument, and the next time Edison came into the room I showed it graph inventions. The world was at Edison came into the room I showed it that time looking expectantly to Menlo to him. He seated himself on a high Park for the solution of practical elecon the board and his head, face down. on the board and nis nead, race town, on them, and seemed lost for some time in thought. After some minutes he raised his head and addressing me said, "I do not pay you to make suggestions to me. How do you know but that I mailtoned bed which idea and now if I mailtoned bed which idea and now if I mailtoned bed which idea. He said it was sike the one designed by to me. How do you know but that I al-Siemens, and told me to go over to his ready had that ides, and now if I use it Slemens, and told me to go over to his | ready had that ides, and now if I use it library and set from Dr. Moses, the | you will think I took it from you." I as-librarian, a certain book in which I sured him that I considered anything I would find a machine like nine de-could produce while in his supploy said, serbed I did so and found, as he had pertaining to his interests, belonged to said. Silemens' dynama dimest exactly him; that my thinking on those lines the same as the one I was working on, was due to my being in his laboratory. I remember the book contained a photo-induced of the needs and lines of graph of the machine, and it was a fair | work. He made a test of my meter picture of my own machine, design of scheme, and onvivitheranders ! looked

with all the conveniences required, balance room, middle furnaces, air presetc. I was thrown into association with most agreeable companions. I, at this time, formed a close friendship with Dr. Edward L. Nichols, who had recently returned from Europe, where he had followed an extensive course of study in the foremost universities of the Conti-

nent. He was at this time doing special scientific work for Edison. The doctor is now Professor of Physics at Cornell University. I made a number of special investigations for Edison—especially on the filament for the incandesent lamp. I had every opportunity to use my inventive faculties

I think it was in the following De er that I was one day called by telephone to go down to the new lamp (ac-tory and see Mr. Edison. When I artory and see Mr. Edison. When I a rived at the factory I found Mr. Edison Francis R. Upton, Charles Batchelor, and Edward H. Johnson in conference; these three gentlemen were partners of Ediand looked after various departered into their present ments. I was ush and Edison informed me that Mr. Batchelor, who was in charge of th struction department, and operation of the lamp factory, was soon to sail for Europe to prepare for the exhibit to be at the electrical exposition to be held in Paris during the coming summer, and that he wished me to take charge of the factory. I demurred, and said I would much prefer to remain in the on experimental said that lamp manufacturing was still experimental, and he was kind and frank enough to say he wanted me to take hold of it because I was a thinker. He won the day, and under Mr. Batchelor's instruction I began my duties. I think it was the third or fourth day after I had been there that the follow ing conversation occurred between Batchelor and myself: "Mr. Batchelor, Batchelor and myself: "Mr. Batchelor, how much am I to get here as salary?" I asked. "How much have you been getting at the laboratory?" he answered. was getting seven dollars and fifty cents was getting seven update and any per per week." "Well, I think we can do a little better here," he said. "You will have to pay me one hundred dollars per month if you wish me to remain. I was getting seventy-five dollars, and could have had ninety dollars per month from the Standard Oil Interests, but I threw that aside to enter experimental work," I replied. "That is more than we can afford to pay," he said. I told him I was of the same opinion, owing to my inexnerience, but he would have to me from continuing. I did not return the next day. Mr. Upton, against his will, was required to take charge and re-lieve Mr. Batchelor.

I sat around my boarding h several days, and spent most of the time wondering if I had made a mistake. Finally I brought my courage up to the point of walking up to the laboratory. When I entered I met Edison, and he laughingly joked me about not being able to stand the work of the samp fac-tory. Then he said: "There in the end of the room is a hydraulic press; have laboratory, offire, machine abop, and a graph of the machine, and it was a fair work. He made a test of my meter it put in order, and make for me a small new building to be used as a lamp factory, the first of its kind ever constructed. There were probably two hunders are the frame and all. I then changed its possible, it proved a fujure. Immediallies a borseable, I was taken the form that of a rotating transformer, attly after this incident, I was taken and great activity existed. A few days ance was formed with Mr. Edison, I was the original experimental department, wide and two days in the sub-transferred from the position of assist I was now in my play. I had a large taket. I will keep the sub-transferred from the position of assist I was now in my play. I had a large taket. I will keep the sub-transferred from the position of assist I was now in my play. I had a large taket. it put in order, and make for me a small for you to press sheets between, and a second property of make for punching out the fitaments.

When you make one capable of mounting his lamp, I will give you a prise of one hundred delians." All of which was done wished, and I received the one hun d dollars. I find I now have in ate an ordinary visiting card on which pasted one of these graphite loops, and the card is written:

"Munto Pank, N. J., Feb. 11th, 1881. Hydraulic pressure one hundred tons (This referred to total pressure on a sheet of graphite about one and threehes by four inches from which the loops were punched.) fifteen ten-thousandths of an inch. This loop won one hundred dollars as a prize; the prize being offered by T. A. Edison the prize being once...
to the undersigned.
"E. G. ACHESON."

Mr. Edison then ontered into an agree ment with me to make thirty thousand of these filaments. I sugaged a man and a boy to help me, and became so expert a boy to neip me, and became so expert at making them that I was earning twelve dollars per day by the time six-teen thousand had been turned out. Edison at this time was occupied in New York, building the first electric lighting station in Pearl Street. The filaments I was making of graphite produced a magnificent light, but they not last long in use, disintegrating rapidly. I had made sixteen thousand of them and then went to Mr. Upton and told him that I was not happy in making an inefficient article, notwithsta ing it was yielding me a great deal of money. I considered it a waste of money yould much prefer to throw up my contract. He wrote to Mr. Edison ab the matter, and in a few days I received the following letter:

"New York, April 20th, 1881. "Mr. E. G. Acheson,

"Menlo Park, N. J.

"Dear Sir:

'You had better go into the lamp fac tory and learn the lamp business in all its details. Yours truly,

"THOS. A. EDISON"
I at once knew this meant my prepa ation for a sojourn in Europe as expert in electric lamp manufacturing. I now returned to the lamp factory, which I had a few weeks before left, but under very different auguices. I went through of the departments, learning to The file. the work with my own hands. ments were then made of bamboo. I them, mounted them on their platinum wires, which I had sealed in glass, for base of the lamp, called "inside"." I sealed the "inside part" into the glass globe, exhausted the air from the lamp, sealed and tested it and pre pared it for shipment. I studied the de-tails of the various machinery and apparatus of the factory, and made myruct and oper petent to cons one. My relations with Edison at this time may be gathered from the follow ing letter:

MENLO PARK, N. J., May 2nd, 1881. Mr. E. G Acheson:

ease come up to the laboratory and bring one of those nickel molds in wi they bend the fiber to carbonize it, and press a piece of plumbago the thickness of the mold. It is, I believe, one-eighth of an inch, and then hollow it out for the nickel piece to allow the carbon to draw up. After you have got it, have Dr. Haid pass the gas over it. I want te: unn .17 we cannot make these little moids out of plumbago, using the pickel piece to put straight on the fiber use there, it would save a great deal of money. Also try some ex-periments on getting the best mixture of litherge and glycerine, also the right propertions of plaster of Farjs for the

ts of the lamps. are lame on these points. Your

night diligently at work studying electrical distribution, measurement, and the science generally. At this time the liter-ature devoted to electrical science was I have here before me a book to which I owe much: it is certainly dry reading, but I worked hard over its contents. It is entitled "Reports of the contents. It is entitled "Reports of the Committee on Electrical Standards, ap-pointed by the British Association for the Advancement of Science," published un-

After I had fairly well mastered the lamp business, Edison had me prepare a complete set of instruments for measuring the efficiency of lamps. These consisted of a rheostat, condenser, gal vanometer, standard cell, resistance colls Wheatstone's bridge, and photomete This last-mentioned instrument was the one built under my supervision according to my design. A description of this photometer is given in the vol-ume "Dynamo-Electricity," by George B. Prescott, 1884.

The Dedication of the Diamor Match Patent to the Public

ON January 28th, 1911, there was corded in the United States Patent Of fice a remarkable instrument. the formal, legal relinquishment by the Diamond Match Company of its right under Letters Patent No. 614,350, granted November 15th, 1898, to Henri Sevene and Emile David Cahen, of Paris, France, for an "Improvement in Match Composi-tions."

This action by the Diamond Match any was the outcome of a series of events which were of international importance. The deleterious effects of the ture of matches has long been the subject of serious investigation, with the resuit that in European countries the use of this poleonous relations, except in combination with counteracting agents, is regulated by law. It is well known that white phosphorus causes necrosis of the jawbone and teeth, and the principal suf-ferers therefrom have been those em ployed in the manufacture of the common

The Bureau of Labor at Washington Charles P. Neill, Director, has conducted a series of experiments, covering an in vestigation of match factories in the United States, and the conclusions reached were so overwhelmingly against the existing process of match manufe ture, through the use of white phospho rus that it led to a recommend the President in a message to Congress looking to the attaching of a heavy tax on those factories using the phosphorus

The result of such legislation would, of course, compel the manufacturers to de-vise a suitable substitute for white phoswith the possibility of being phorus, with the possibility of being charged high royalties for the use of processes already controlled. The sug-gestion for legislation was looked upon with disfavor among some members of ress. who considered it an abuse of the tax privilege, and also saw in its operation the possible building up of a huge monopoly on the part of those who con trolled patented processes of substitutes for white phosphorus.

The Sevene-Cahen patent covered a nou-The Sevene-canen pattern covers a man-poisonous sesqui-sulphide of phosphorus, one of the few known adequate substitutes for white phosphorus. The Diamond white phosphorus. Match Company was the sole owner of this patent, and the company was thus in a position, if prohibitive legislation were enacted against white phosphorus, of controlling the match output of the try, or else of being able to collect large

royalties for the use of the Sevene-Cahen process.

Rather than be placed in the position of being a beneficiary under legislation that was needed for humanitarian reasons, the Diamond Match Company has abandone The I was thus properly myser it by the right to the securiously thing process to provide the properly myser in Pennsylvania more than the properly myser is destroic incoming the process of the properly myser in Pennsylvania many well-securious and the properly myser is the properly myser in the properly my

States forever. The instrument abando ing its rights to the Sevene-Cahen patent was accordingly prepared, and was re corded in the Patent Office. Commissione of Labor Neill, Edwin R. A. Seligman and Jackson H. Ralston acting as trustees The relinquishment is also signed by Ed ward R. Stittinius, president of the Dis mond Match Company.

The effect that this will have match industry of the United States is far-reaching. It will enable every match manufacturer in the country to operate without endangering the health of his employees or putting upon the market a substance well known to be poisonous and

The Sevene Cahen substitute for white phosphorus, while being harmless to the health of the workmen, possesses a def inite chemical composition and is easily infammable. This sesqui suiphide of phosphorus is obtained in a state of purity by distillation. The formula described in the patent is as follows: Ses qui sulphide of phosphorus, 90 grams chlorate of potash, 800 grams; peroxide of iron, 110 grams, zinc-white, 770 grams; powdered glass, 140 grams; glue, 100 grams, water, 290 grams. The advantage of this formula as claimed over the various preparations of mixed pastes for matches, such as a mixture of amorphou phosphorus and sulphur either in pow der or the state of fusion, is due to the fact that the sesqui-sulphide of phospho rus is very stable, resists moisture, and can easily be utilized and manipulated in dustrially.

It is not known whether the action of the Diamond Match Company in thus freely giving to the people of the United States the use of this valuable formula will have the effect of rendering unneces sary the proposed legislation aga use of white phosphorus, but as the Sev ene-Cahen process has been used with great success by the Diamond Match Comand it is the only non-deleterious substitute that is commercially practical there appears to be no good reason why the other manufacturers of matches in the United States shall not now use the harmless process, thus doing away altogethe with the use of white phosphorus.

The legality of the document signed by the Trustees and the Diamond Match Company will hardly be questioned.
While the patent has about five years to
run, it is assumed that the contract between the Diamond Match Company and the inventors has been fulfilled, or be fulfilled. Since the in ventors are not recited in the instrum lately recorded in the Patent Office as be ing parties at interest, it can be rea ably deduced that their claims under the

patent have already been satisfic There is apparently no "string" tied to this free will offering to the American public, and the Diamond Match Com pany by this act places itself in the posi tion of a public benefactor In these days of monopolies and trusts it is an unusual quishing for the benefit of the public in terests which if taken advantage of can be made to yield hundreds of thousands of dollars

The Death of Frederick G. Hess R. FREDERICK G. HESSE, a dis identified for the last twenty-nine year of his life with the department of me chanical engineering of the University of California, died on January 27th, 1911

at Oakland, California,, at the age of eighty-six years

His career was full of action and inter est. He received his education in Ger many, and, after serving in the Prussia army, took part in the 1848 uprisings Like many other revolutionists, he wa compelled to seek refuge in this country. Here he became actively engaged in engineering projects. After lecturing at Brown University on engineering, he was

San Francisco to practise engine was here that he became interested in inventions Perhaps his best known in-vention is the centrifugal pump with

The Report of the Commissioner of Patents

THE Commissioner in his sunual report takes up first of all the subject of the examining corps of the Patent Office. As the result of an augmented force and increased salaries, the general standard of the work has been raised, the searches have been more thorough and more care to attract and retain men of special tech

nical training and of university education
The trade-mark division is commented upon with less optimism Application en made to Congress to provide a force of assistant examiners in trade marks and designs. When these are furnished, it is expected that the work of the division will be placed on the same level of excelience as that of the regular examining orns. The Commissioner sity of a new trade-mark law, which should be passed after the forthcoming Congress of the Union for the Protection of Industrial Property This congre to assemble at Washington in May of year.

Great benefits are looked for from the work of classification of patents, which is at the present time about half completed The Commissioner recommends doubling the force engaged on this work, as the saving of time which is gained through having at command properly classified ma terial would far outweigh the additional outlay.

It is urged once again that one of the appeals should be eliminated from the present practice of the Patent Office. It is suggested that three members of the pres ent Board of Examiners in Chief, together with the Commissioner, First Assis Commissioner, and the Assistant Commissioner, should be formed into one appellate court, to whom appeal should be made directly. This would result in a great saving of time and money to inventors. A bill making these changes has been pass by the Senate and has the approval of the Secretary of the Interior, and it is hoped that the measure will be enacted into statute as soon as practicable. also has the approval of the President of the United States, who is much interested in lessening the expense of litigation and simplifying court proceedings. Among the changes which have oc-curred during the past year is to be re-corded the repeal of the caveat law. Our readers are familiar with the circum-stances of this matter. The only course open to an inventor now is to file an

application for a patent Another very gratifying change in patent statute is the law enacted during the past session of Congress, whereby an instrument is placed in the hands of inventors, to enforce payment to them of proper compensation for the use by the government of their inventions. pointed out that in the absence of such protection a certain class of inventions, which owing to their nature can find purchasers only in national governments, were seriously discouraged, or worse still, the inventor was driven to sell his proluction to foreign nations

Several treaties have been entered into with foreign countries, and the laws of several countries have been changed as regards the so-called working clause A notable case is the treaty with Germany, which has been successfully negotiated In its broad workings this treaty effect of not only protecting the American inventor, but the German inventor as well The treaty has been construed by the imperial Court sitting at Leipsic, and its provisions were upheld in some patents which had been declared forfeited, and they were ordered restored by the German Patent Office Treaties of like import are now pending with other countries

The Fourth International Conference

of American States, which convened at lucenos Aires, Argentino, in the animer of 1910, passed upon three conventions relating to patents, trade marks, and copyrights prepared by the Commissioner. These conventions are awaiting ratification by the respective governments represented, and their final adoption will result in great benefit to all the nations belonging to the Pan-American Union. One of the provisions of the trade-mark convention protects the Red Cross and Geneva Cross from improper use

Those possessing trade-mark rights in the Red Cross prior to the passage of the law may however continue to use it still

All the nations of the world, both those who are adherents to the Paris treaty of 1883, and all others, have been invited by the United States to hold the next Congress of the Union in the city of Washington, beginning May 16th, 1911.

The President of the United States has, through the Secretary of State, appointed as delegates to represent the United States at him congress, the Commissioner of Patents, Hon Edward B. Moore, chairman of the delegation; Hon, Charles if Duell, former Commissioner of Patents and ex-Justice of the Court of Appeals of the District of Columbia; Frederick B Fish of Boston, Melville Church of Washington, D. C., and Robert H. Parkinson of Chiesgo, all of whom are leaders of the patent bar and well-known authorities in patent law and practice.

The efforts of the American Bar Asso ciation to establish a court of patent ap-peals are strongly indorsed by the Comoner, who, at the request of the Com mittee on the Judiciary of the State, re cently advocated the speedy passage of the bill creating this court The patent profession is practically unanimous in its sun port of this movement. The Commissioner concludes his report with an appeal for dditional working space for the Patent Office. He points out that the present building is entirely inadequate, even for the present conditions, and is rapidly be coming more and more so with the ever increasing business transacted by the Office. He draws attention to the net surshown in favor of the Patent Office since the time of its origination to the present, a sum of \$6,998,227, which he urges should by right be spent in furnish ing the accommodation required for properly serving the interests of that class of the community from whom the receipts

Patent Oddities

Curious Shell for Artillery.—Seeking to provide a means for attacking an enemy concealed behind an intronchment, a German howestor has devised a peculiar form of shell, which in reality is an aerial automatic magazing gun. The conter of the shell is filled with explostre materials and shrapnel shot, which is intended to be exploded as in an ordinary shell at a predeterment moment. In addition to this, there are four partitions, in each of which there is a series of holes adapted to receive rife cartridges. These holes form an acute angle with the axis of the shell, and are directed backward. By means of a timing device, the cartridges way be detonated successively to discharge bullets in the ways of the shell.

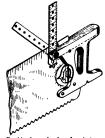


Curious shell for artillery.

The idea is to regulate the speed of the bullets, so that they will strike backward despite the forward motion of the abel, and attack the enemy behind the trenches. Of course, in such a system, the majority of they fullets would be wasted, as only those that were directed downward at the moment of discharge would strike the enemy with sufficient energy to do any

damage. Furthermore, the position of the shell, unless it were given a very flat trajectory, would make even these bullets harmless.

Combined Saw, Level, and Projecter.— The back of a new makes a very good tristalkhedge, as all carpenters know. A Western inventor has hit upon the loca of improving this straight-deg by graduating it in inches, thus converting it into a scale or rule. In addition to this, he uses a graduated blade pivoted to the saw handle, and provided with a pointer



Combined saw, level, and projector.

that swings over a graduated arc to show the position of the pivoted biade with respect to the straight-edge. This prejector, if set at right angles to the saw blade, gives him a square. Still another attachment for the saw consists of a spirit level mounted in a swiveling table, with a pointer and graduated arc that indicates the position of the level with respect to the straight-edge.

Safety Gas Valve.—Considerable attention has been paid by inventors to the question of turning off the gas when the fame at the burner has been extinguished by a draught or in any other accidental way. The sectional view here published shows a recent invention seeking to accomplish this result by using the expansion and contraction of mercury. Sur-



rounding the gas jet is a reservoir filled with mercury, containing at one side a cylinder in which a piston is fitted. This piston is connected to the valve When lighting the gas, the heat of the match expands the mercury, forcing the piston outward. But should the gas be extinguished, the mercury would contract and would draw the piston into the cylinder, thereby closing the gas valve.

The Air Mattress in Olden Time A S we at the present time enjoy the trees, we are apt to regard them as modern improvements. It is, however, a long hark back to the original blown-up bed. They were certainly knows and used as early as the sixteenth century An old cut accompanying an early translation of Vegetius A D. 1511 shows armed soldiers reclining on an inflated mattress, a bellow being connected with one corper for convenience in blowing it up. The sleeping soldiers look as if they had entirely forgotten "war's slarms."

Legal Notes

d Limited Putent Pro Among the novel suggestions for changes in the existing Patent Laws is one which would contemplate a more limited period for certain patents to run. It is con tended that many patents are now a lowed on articles which the patentees are not in a position to use themselves, and which they are unwilling to dispose of to manufacturers and others, except at exorbitant prices, thus tying up for seven teen years devices and improvements of various descriptions which, if procurable at reasonable terms, would be of use to the trade. The contention is almost made there are many devices patented that there are many devices patented which show invention and are legitimately patentable, but which in reality have no commercial value. It is suggested that a varying scale of protection be established permitting the Patent Office, in its discretion, to apply to certain the contract of the contract tain patents only a limited term of pro-tection, thus hastening the time wher certain devices, useful in only a very re stricted way, shall be given to public use While these suggestions were made in good faith, it is perfectly obvious that the Patent Office could not be placed in the position of determining the value of the position of determining the value of an invention, a thing which is in almost every case problematical. The value de-pends upon the utility and demand, and this cannot be calculated in the Patent Office, and to draw the line beween inventions meriting full protect tion and those which do not, would be impossible Neither could an inventor be compelled to disclose his conceptions to those to whom they would be mos useful, since an invention is the produc of the brain and therefore the sele property of the inventor. The present seven teen-year term of shuciute protection est hardly be considered too long for a n to have possession of his brain child.

The International Congress—Proparations are now going forward in Washington looking to the entertainment of the forthcoming meeting of the International Congress of the Union of the Protection of Industrial Property. This meeting is to be held in Washington in the month of May, 1911. The congress is expected by those having charge of the arrangements to be the most important of its kind ever held. It will be attended by many distinguished representatives. The Treaty of Paris of 1838 will be up for discussion, and important amendments will be made to that freaty. M. Morel, the director of the International Bircau of Berne, is in charge of the programme which will be brought before the conference. This is the fourth congress to be assembled, and in addition is the magnitude of the magnitude, and in addition is the magnitude.

congress to be assembled, and in addition to those nations which adhered As we at the present time enjoy the luxtwenty Latin-American countries have been invited to send delegates, and are expected to accept. As most of these delegates will be accompanied by their wives and daughters, a very large assemblage will be prepared for. Weshington its at the height of its beauty in fington is at the height of its beauty in fington is at the height of its beauty in fington will be prepared for a chair of the section of Washington will be known as a "Diplomatic Congress," many of the delegates being distinguished diplomatists and savants. The Department of State will have charge of the congress, and the United States delegates have already been commissioner of Patents and former Justice of the Court of Appeals of the District of Cotumbia; Hon, Edward Brues Moore, of Cotumbia; Hon, Robert H. Parkinson, of Cotumbia; Hon, Robert H. Parkinson; of Cotumbia; H. Pa

Brief Notes on Invention

U. S. Patent 1,000,000, "The last United States patent terred in 1810 is numbered 300,177. It is thought that patent numbered one million will issue some time in the late spring or early summer of this year. At one time the starting of a new series in order to avoid the high numbers was suggested, but it has been decided to make no change, and the numerical numbering of the succeeding issues will continue as before.

Patents and Politics. -Patents have not Patents and Politica.—Patents have not only influenced commercial affairs, but have also had a political force, and patent litigation has, at least indirectly, played a large part in the nomination and election of one President of the United States. Except for a larger retainer opportunely received by Abraham Lincoln in an important patent suit, it is doubtful whether he would have enwhich led up to his nomination for the high office. The story goes that Peter H. Watson, a leading patent attorney of his time, had charge of the McCormick reaper interests and it was decided to seek the services of Mr. Lincoln in a patent suit being tried in the Illinois district. When Mr. Watson sought Mr. Lincoln he met the latter holding a letter in his hand. After a consultation, Mr. Lincoln agreed to enter the case and a retainer of several thousand dollars, a large fee for the time, was banded to him. As the conversation proceeded Mr Lincoln tore up the letter was holding, and remarking that it required explanation, told Mr Watson he had just received a request from the Illinois Republican Committee for him to engage in a series of joint debates with Stephen A. Douglas. It is easily It is easily understood that he appreciated the in-vitation and all the opportunity meant for him. He told his caller that after carefully pondering the whole matter, he had been obliged, because of his financial condition, to decline the invitation and had done so in the letter which he had just torn up; that the retainer he had just received put him in a position to render the political service desired and that he would write a different let-ter and agree to enter upon the debates. The rest is well-known history

Trade-Marks and Imported Goods.—In eaking to protect domestic manufacturers or traders as well as traders and manufacturers located in any foreign country which affords similar privilege to citizens of the United States, the trademark act approved February 20th, 1905. in Section 27 provides that no article of imported merchandise which shall copy or simulate the name or trade-mark of any such trader or manufacturer shall be admitted to entry at any United States Custom House To aid in enforcing this salutary prohibition, the statute further provides for the recording in the Treasury Department of the name and residence of the maker, and the locality in which the goods are manufactured, and the certificate of registration of the registered trade-mark. While this privilege is open to the thousands of traderegistrants who must be interested in the subject, it is surprising to learn that the number of persons, firms, and corporations who have actually availed themselves of the privilege of so recording with the Collector of Customs since the act of 1905, is only about eighty.

They are: Hon. Edward Bruce Moore, Commissioner of Patents, chairman; Hon. Frederick P. Pish, of Boston; Hon. —Water besting devices including hold-large H Duell, of New York, ex-Commissioner of Patents and former Justice caused to circulate were used in ancient of the Court of Appeals of the District Roman bollers; the original nickel-in-the-of Columbia; Hon. Robert H. Parkinson, else maked the continuous with the continuous single state of the control of the contro

whose limbs were moved by the pulling of strings amused the children of the early Egyptians, and explosive engines were devised early in the last century erein motion was given to pistons by the explosion of sun powder. In fact, an explosive engine was patented in 1807 in France in which a mixture of hydrogen and air was exploded and utilized to meye a carriage (practically an automobile). This machine even ignited the explosive charge by an electric

The Government and the Inventor.— That the government of the United States is not generous in its treatment of inventors for the use of patented in ventions is evidenced by an official report of a Cabinet officer. The Treasury Department contains many instances of the use by the department of patented the use by the department of patented inventions for which nothing was paid the inventor and patentee. In one case the patentee made affidavit that the use of his formulas has saved the government from \$5,000 to \$8,000 per year, and his chief made a signed statement to the same effect. The inventions made the same effect. The inventions made by government employees and officials include nearly all classes and range from armor plate, cartridge beffs and field stoves in the army and navy through erasers and cutlery cleaners to the more peaceful agricultural inventions. tions relating to the treatment of hog cholers, and the inventions have been connected with practically all of the de partments of the government. The list of patentees contains many well-known or patentees contains many well-known names, including General Anson Mills, U. S. A.; Willis Moore, Chief of the Weather Service; General A. W. Greely, U. S. A.; General Wm. Crozler, U. S. A.; Admiral Hichborn, U. S. N., and numerous other officers of the army and navy. While some of the patentees have reaped a reasonable reward, in many cases absolutely nothing has been paid them in return for the exercise of their inventive powers. All this is now inventive powers. All this is now changed by a recent law empowering the Court of Claims to act in patent cases against the United States.

Sheet Aluminium. -- Sheet aluminium Sheet Aluminium.—Sheet aluminium states the American Machinist, makes better vise jaws than either copper or brass. It can be obtained in any thickness from machinists' supply houses.

The Tungsten Lamp on Railroads.— phone as normally In the Yale Scientific Monthly the gening ring eral superintendent of motive power of the Pennsylvania Railway states that there is no doubt that the tungsten lamp will replace the carbon lamp for trainlighting work. The success attending its use may be attributed to the development of the so-called "hot circuit." By means of this method, instead of turning the current completely off from the lamps when light is not required, the lamps are merely disconnected from the main batteries and joined to one or two "hot circuit" cells, sufficient current being thus passed through the lamps to show merely a faint red at night. This arrangement minimizes, the breakages of the filament

Ricctric Lights for Druftsmen. - Elec tric lights for drawing boards in an of-fice where the work requires very long drawings, states the Engineering Record, are suspended from wires strung below the ceiling parallel with and directly ver the boards. The connections are sken from convenient ceiling outlets and the lamp cords are permanently tied to small white percelain speel insulators. These insulators are strung on the wires by passing the latter through the nail hole. Sufficient cord hangs from the insulator to allow the lights to be dropped quite close to the boards, and enough slack is left between the inquistor and et plug so that the lights can be boots and so that the again can be mored a comificable distance along the wire, and thus be placed directly over the chaired point without moving the fraction. This is carticularly advantage-

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The cotices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCHMILPIC AMERICAN.

The weekly Index of Patants issued by the Unite States Patent Office will be found in the Scientifi American Supplement.

POTAINING to Apparel.
FOOT GLOVE BIACE.— HISROYTMUS
FINCIES, 5d Grand Aroune, Corona, N. Y
In operation, the brace illustrated herewith is
first placed on the foot and the stocking adjusted with reference to the said irrace prior
to placing the foot in the show. When the



FOOT GLOVE BRACE.

foot is placed in the shoe it will be found that the leather of the brace adheres to the leather and lining of the shoe much more saugly than with the stocking foot, therefore, the foot, when properly incased in the covering, is prevented from plunging forward into the toot of the side.

ling, is prevented from plunging forward into the COM of the State II. Now York, N. Y. This invention relates to certain improvements in that type of turn-down collect in which the rest position is no constructed as to separate the needle from the bad of the collar button the media from the bad of the collar button that the collar button in adjusting or Unit the this process of the State II. The STATE II. The STATE II. THE MET IN THE MET IN THE STATE II. THE STATE III. THE STATE II. THE STATE II. THE STATE II. THE STATE II. THE STATE III. THE STATE III

Rioctrical Bevices.

Ricerbrical Besteves.
TELBHITIONE MOTITIFIETE — I. STEPNDERMER, New York, N. 3. The mouthpiece has upon its outer petiphered close a strengthening member of assular form, separate from the with Ten invention comprehends moniting upon the mouthpiece adjacent to the above close, a protecting member and legend plate having substantially the form of a flat ring, and shaped to display beyond, including robust and supplemental control of the control of the

increasily locked in position by aid of a lock-ing rise in the control of the co completed.

Of Interest to Farmers,

CANT KNIPS.— B. M. Instanting devices

[CANT KNIPS.— B. M. Instanta, Iris, Miss

By the construction in this lawrenton, the
laider can be set to any desired angle and
accured in such position and thus adapted for
use in any manner required. The handle is
composed of sections united together by
threading a tenno at the seld of one section
into a society in the end of an adjacent sected to a society in the end of an adjacent secabit to adapt the kills for use as a serbias an ordinary cane cutter, and for use in
calcen quarter.

CORN FLANTER.— J. VINTON. Spoksan,
Wash. The purpose of the Inviscions is to
previde sin stiachment for corn planters,

which will enable the operator without any mathematical procedure, and at a ginner to determine the exact point at which to commone the new row, in order that the hills may be in a straight like both longitudinally and transversely of the field HOG FERDIN APPAIATUS CHARLES G HOWARD, R F 15, No. 3, Box 47, Exert, Nethen the strength of the provides an apparatus for feed inc cuttle and more particularly swine, which livery of the food, provides an apparatus where the door for delivering the food may be



TOO PERSON

readily and quickly adjusted, and provides a construction which is simple, economical, and durable. No far as possible all the members shown in the engraving are constructed from motal, the sides and top, as well as the frain ing channels below the floor of the troughs being of short mental, while the roods, both, and disk forming the losk for the Jaous are prefer-sibly formed of hear and plab - metal

suby formed of har and plate inetal
MOWING MACHINE—M. G. Oris, Aniwa,
Wis. This invention provides a construction
whereh is provided means for driving the
whereh is provided means for driving the
the carrier is rapidly sectuated to answer the
expediences which aske he the operation of
unachines of this cheracter, provides means
for connecting the draft meanism to the
outer bat, and provides an operating mechanism for religiousling the cutter har,

neral Interest.

Of General Interest,
RIVER BANK PROPERTOR:—T W MATEY
and A A Brank Power, tolo This larves,
then refers to a device adapted to be used to
protect the bank of a tiver, stream, or other
body of water from being washed away, and
which also may be used to change the channel
of a fiver or stream. It pravides a boom
which will protect the bank, with a coarsemeaded one on the luner side, whereby the
current is retarded to a gradual manner.
PALMITEN WATERLIPHONING COM-

current is retarded in a gradual manner.
PALMITIN WATERIFROSPINO COM.
FOUND AND PROCESS FOR MAKING THE
SAME—E MAS, New York, N Y. This invention perfains to an compound and the
method of making the same, and more parferridate visites to the treatment of paintitin
in a solid and non-inegations condition, as a set
to the same of it as forming the base for
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a vehile.

HAM PTMP -1, 8 Hanns, 8nn blign, 6a.

The objet here is to provide a device especially adapted for introducing prickle into hams, but also capable of use as a measuring device, which is operated by the pressure of the liquid to be jumped, and wherein the quantity of liquid "jerted at each streke or the principle of the pump now he varied. Mr. Hardy has also literated mother ham pump for use in fact, in the property of the pressure of the pumper of the pumper of the pumper.

RANTARY PILAUW —V., RRHIDEN, Schneiden, and the pumper.

SANITARY PILLOW -- V. RESHUN, Schagh-

pump and the property of the pump and the pu

Household Utilitie

Mousehold Tillities.
CONDIMENT HOLDER IP I Lacy, Slouz
City, Lowa The invention is an improvement in that class of condimental-orders which are
subject to the condimental conditions of the sadapted for holding a corresponding number of different condiments, such as sail and popper All the principal parts may be struck up not of thin sheet metal and the partition may not of thin sheet metal and the partition may ing or rivering solely by means of the inserted bottom.

CUBPIDGE TONGS—J. R. Earros, Marion, N. D. The more particular purpose in this case is to give the tongs such construction and operation that, by their aid the cuspidor may be grasped, washed, turned bottom upward, if need ie, and released or turned back into its nominal position, as desired, without the necessity of the operation placing his hand directly upon the usuphlo.

Heating and Lighting.

Heating and Lighting.

Oll, Birks, H. L. A rass, Seal boughs
Mass. In this case the Invention relates to a
birmer of a type dasped to span a suitable
combustible oil, such as kerosen and finely
atomic it and mix it with a suitable quantity
of air before supplying it to the
burning
maxie. An object is to protice a burner with
twith a preliminary supply of air, and with
means for forether distinctanting or atomizing
the oil and mixing it with an auxiliary supply



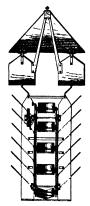
OIL BURNER.

of air. The illustration represents a vertice longitudinal section through the center of the device.

Machines and Mechanical Devices.

Machines and Mechanical Devices.

I MP: P. & A Bregar, and P. C. Pracer, Shoulder P. & A Bregar, and P. C. Pracer, Shoulder P. & A Bregar, and I do doubte acting as well as direct acting. The exhaust air is utilized in siding in the fitting of the water estimates that the full effect of the continuous that the full effect of the continuous that the full effect of the continuous actinuous actinuous and the action of the pump is controlled by a totatable rather than a reciprocated prometer. As the colonia rather by the form of the state of the water The engagement of growed wheels on the ends of



CURRENT MOTOR FOR RUNNING STRLAMS

hafts or rods with the tracks retains the upper and lower run of chulus horizontal and linearce that each some or linds will be expected in the control of t

any position on a cask and with any desired degree of tightness during the process of as-sembling and bending the staves in a trusting machine as usual.

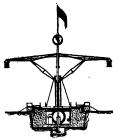
monthing and declining from staves in a truesing machine as used.

WATER WHIERL MECHANISM.—T. A. WATER WHIERL MCLANISM.—T. A. WATER WHIERL STATES AND A STATES AN

Railways and Their Accessories.

RAIL ANTI-CREPTING DEVICE—J. G
WOJFR, New York, N. Y. The intention of the
inventor is to provide a new and improved
rail anti-creeping device, which is simple and
durable in construction, easily applied, and
arranged to prevent creeping of the rails in
the direction of their length incident to the
arction of the wheel of passing trains.

OBSERVATION BOUNDABOUT—VINCENT DAVISON, P. O. BOX 1991, Goldfield, Nev. he accompanying illustration is a side view an observation roundabout with arms ex-nded, the device being especially adapted for



use at fairs, expositions, etc., whereby a large number of people may be entertained. It is capable of elevating a number of people to a considerable height above the ground, and then rotating so as to give the patrons a good view of the grounds and the surrounding country.

Pertaining to Vehicles.

RECTIONAL WIND SHIELD—W. G. Cox.
Alhany, N. Y. The aim in this invention is
to provide certain new and useful improvements in sectional wind shields for automobite and other vehicles, whereby the upper
section of the shield can be readily swung
upward into an artended position or downward
upward into an artended position or downward
termediate position, and to securely lock the
section therein in a simple and convenient
manner.

WHIPPLETERER. O. H. SMITH. NEW BIRMS.

manner
WHIPPLETERE. O 11 Surry, New Brunswitz, N. 1. Amount the principal objects which
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POWER TRANSMISSION ATTACHMENT POWAR TRANSMISSION ATTACHMENT POR AUTOMOBILES E Z-Accur and GI Basin, Junean, Neb. As this attachment is constructed, it is adapted to support the rea-szle of the automobile, with the wheels mounted on the sale raised from the ground and to hold in frictional contact with the wheels of the automobile, driving wheels, the wheels of the automobile, driving wheels, the which is mounted a pulley which may be con-nected by means of a field with the machiner, which is to be driven.

which is to be driven.

RICYCLE GRAR - F. V. WHITMAN, Walker-ville, Mont In the present patent the lavou-tion is an improvement in blicycle-gener, and the object of the inventer is to provide a driv-ing mechanism, wherein the rotating renals shaft is replaced by oscillating 'ellow levers, and wherein a simple form of garring connects the show levers with the driving wheel

Norm—Copies of any of these patents will furnished by the RCHENTIFIC ARMICAN for consists.

Please table the name of the invention, and date of the panes.

NEW BOOKS, ETC.

A TREATER OF THE UNTREASE, BY G. W.

B. Lipplicott Company, 1910.

The moders development of electrical theory has been extended over the sellies fleid of pistrated phenomens, for which reason there is a present of the pistrate phenomens, for which reason there is a present of the pistrate phenomens, for which reason there is a present of the pistrate phenomens, for which reason there is the pistrate phenomens, for which reason there is the pistrate phenomens, for which reason there is a pistrate phenomen of the pistrate phenomens, for the pistrate phenomens, for the pistrate phenomens are employed in pince of analytical demonstrations. On the whole, the author has a stronged with a great deal of success the vive difficult to also dipresenting in a form phaysical student possessing only an elementary mathematical confinence, a consected outline of conserceions which cover many astence. Trickal phenomens, which may be commended for its simplicity, the author passes to a discussion of units and measurement. Next he may be commended for the simplicity, the author passes to a discussion of units and measurement. Next he may be commended for the simplicity, the author passes to a discussion of units and measurement. Next he may be commended for the simplicity, the author passes to a discussion of units and measurement. Next he may be commended for the simplicity, the author passes to a discussion of units and measurement. Next he may be commended for the simplicity, the author passes to a discussion of units and measurement. Next he may be commended for the simplicity, the author passes to a discussion of the simplicity, the author has medical theory of electricity. An important chapter is that on the cheric with a simplicity, and the discussion of the chapter on the pistrate of t

tatic, it is his great breadth of view and the many movements in which he has taken an authoritative support. These facts are reflected in the table of contents of the volume before us, which is a collection of seasy, many of them originally placed before the form of the contents of the volume before us, which is a collection as a contract of the volume before us, which is a collection as a display and the contract of the volume before us and the contract of the volume before us and the value of the contract of the value of the contract of the value of the v

discussed, written by the aminent German chronist, in which the energy concept did not figure prominently.

The third section deals with the general The third section of the section is devoted entirely to the movement for an international fundament. As which Orward has been an end-present present. New state here is a collection of papers on the Section serves is a collection of papers on the Section serves is a collection of papers on the section of th

the party of the minorian to describe the authorization of the date of the authorization and supporter for some years past.

Nection serves is a collection of papers on the subject of Public Instruction. Among these the public of Public Instruction. Among these the public of Public Instruction and the subject of Public Instruction and the subject of the subject of the public of

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Words WHIG IT AMERICA. Volume VI.

Words WHIG IT AMERICA.

Words WALL IN Edited by Albert Neisson

AND LIFE AND ALBERT STANDARD STAN

a directory to those living people of Ausgine in where almost verty-feet; to the mention of the control of the

and the several volumes which we have had the pleasure of reviewing show that the work which is done has been well done.

DENTION MACHINERY AND PRACTICE. A HEAD FOOK Of the Machinery and Apparatus. By Thomas G. Mariow, New York: D. Van Nostrand Company. London: 528 pp. Proc. 546. Son. 1510. 800. 1528 pp. Proc. 546. Son. 1510. 1529 pp. Proc. 546. Son. 1510. 1529 pp. Proc. 546. Son. 1510. 1529 pp. Proc. 546. Son. 1520.

HEATON'S ANNUAL A Commercial Hand Book of Canada and Boards of Trade Register. Seventh Year. Toronto, Canada Heaton's Agency, 1911. 12mo.; 540 pp. Price, \$1; postage extra

extra.

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expectation of value to the concrete be of the plain and reinforced. Everything of value to the concrete user is given, including kinds of connent employed in construction, concrete architecture, suspection and testing, waterproofing, coloring and pasting, rules, tables, working and cost data, It is a thoroughly practical work, clearly written, systematic and logical in its arrangement, broad in its scope and gives a lucid explanation of, and a clear insight infif the fundamental principles employed in concrete design and construction. The practical value of the book is enhanced by over thirty-five itself tables, and concise statements of rules and methods.



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jointhing devices and poperations, and coneveryone working in any branch of the planshing trade. A large amount of space in devicted to a very complaint and practical treatment of the subjects of hot water supply, circulation and range boiler work. Another valuable feature is the special chapter on drawing for plumbers. The liberations, of which there are three hundred and fortyserven, ane hundred being full page plates, where drawn expressly for this book and show the most fondern and best American practices in plumbing construction.

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(1288) C. A. E. H. asys: Will you make the control of the control

and methods.

Drop Forging, Die Sinking and Machine Forming of Steel

by JOSEPH V. WOODWORTH, salve of the state on the branch of the state of the s

(13371) C. F L. asks: Please quote me a list (in your Notes and Queries column) of the more important papers on aeronauties published in the SCHENTIFIC AMBRICAN BIFFIC MERI. A. Lark of space in this column will not permit of uri publishing here such information as you require. We have prepared a special list of "important and instructive Ambrican and the property of the list to any of our subscribers on request.

Firmbing

(12372) T. C. W. Gayrs; I. Will you do not not not represent the columns of your pages, 3/3 illustrates, the columns of your pages what are the differences in wates per card treatise and when subject of the columns of the col (12372) T. C. W. says: 1. Will you

(12373) F. E. H. asks: Does water (1837s) F. E. H. saks; Done water when fronce equal or contract! And while it is possible to burst hydraus which have been fronce, by the saint from out, at it not just as the first of the saint expand at the mounts it fromes, but for the saint expand at the mounts it fromes, bottom, and a small flowerpet saucer inverted and for this reason lee fonts upon water. Over the hole. Then fill in a layer of sharp affect it, it from the lee outsteeds by cooling clean sand, rather coarse. A layer of sharp heat any other since fone. You will see said, a layer of puterised charcas with dust heat a water gips or hydraux is blown out, then a layer of said, the said of th



ting over both holes. Then cut a few holes at the top of the window to allow the air to circulate. This will keep the windows frostproof in the coldect weather. This principle, which keeps the air in constant circulation, is a simple one. The air in the window (which was a greater pressure than that in the since it therefore forces itself out through the holes at the top of the window, allowing the cold air from the street to cuter at the buttom. Any one who tries this plan will find it very satisfactory, but eave should be taken in crimming heavy article that will prevent the free circulation of the air.

(12376) C. N. K asks how to make a household filter. A. Ves two stone pots or jars, as shown in the accompanying engraving, the bottom one heing a water jar with side hole, if it can be procured; otherwise, if nauer can be used, the top jar can be removed to enable the water to be dipped out. The top





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February Mid-Month Magazine Number

GISSUED FEBRUARY EIGHTEENTH

Our Nine Billion Dollar Crop

HE Report of the Secretary of Agriculture, recently issued, states that the farm products of this country for 1910 are valued at the stupendous figure of nearly \$9,000,000,000. In the mid-month February number of the Scientific American, we intend to picture the wonderful scientific rise of American agriculture. We are going to tell how much more intelligence has accomplished on the farm than mere muscle; how plants such as the cactus, which we once regarded as noxious, have been converted into delicious fruit by scientific means; how fruits have been created for which a name had to be invented; how the colors of nature have been changed at will and the flowers painted, as it were, by the hand of the scientist; how the soil is vaccinated with bacteria at four cents an acre in order

to enrich it with nitrogen. It is a wonder-ful scientific work that the modern farmer is doing, just as wonderful as that done by the astronomer in his dome or the electrician in his laboratory. The story of this wonderful work is to be told by men who have helped to make agriculture a scientific pursuit; in other words, by the men to whom this country owes a large part of its \$9,-000,000,000, reaped by the farmer this year together with his wheat, corn and rye.

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HARPER & BROTHERS

A Catalogue of Our I

His Life in His Hands (Continued from page 188.) the drawers well secured to preven

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ping, and adds a pair of heavy woolen

If the we be worn. If the depth to be negotiated is great, cotton soaked with oil is put in the ears or a heavy woolen cap pulled down over them. Shoulder pads, if worn to take the weight off the belmet, are next tied on, after which the diver wriggles into his heavy suit of rubber and car vas, sieeve expenders being used by the attendant to make it possible to get into the dress. Next come the inner collar and the breast plate, which are s with clamps to the rubber dress, the ut-most care being taken in this operation not to tear or pinch the rubber. Finally, the shoes are fitted on, and the rubber gloves clamped to rings in the sleeves.

The helmet is last to go on, and never before the valves and telephone had been tested. The attendants start to pump as the helmet is clamped home. The helm of course, is attached to the pump with a rubber tube, which is canvas and wire protected. No diver descends, after the helmet is put on, until he has tested the outfit for several minutes and found that but it for several minutes and round that his air supply is sufficient and the pump working properly. But neither does he delay unduly, for the position in which he finds himself is the reverse of com-

He is supplied with a life line, with which he can signal, should his telephone get out of order, and by which he may be drawn to the surface, should he b come helpless for any reason. He must take great care when walking about on the bottom not to foul his life line, or his air tube, and for this reason must ways retrace his steps exactly to his starting point, if he has gone into a wreck or about any obstructions. For the same reason, two divers, working to-gether, must be careful not to cross each

other's paths.

And when the diver has slipped from the float, dock or vessel where his attenddropped down rope or ladder to the new, cold, dim, greenish, often muddy, world under water, he finds at once a myriad of erils surrounding him. Any interrup tion to his air supply means death. times past, many a good man has died mis-erably in the spouting stream of water which choked him from a broken or cut air tube. To-day, all good diving helmets are provided with a check valve, which prevents water entering from a cut tube, but the air in a helmet and dress would last but a few minutes were the supply Divers may be lost in a wreck, may be overcome from pressure apoplexy, or may have perils from without to contend with, especially in tropical waters, where sharks or croc-odies make the diver's life a matter of terror. Sometimes the life line may be-come so entangled in wreckage that it must be cut, and then there is danger of the diver not finding his way back to his boat or float, especially if the bottom is muddy and fouls the "seeing." But the ,reatest danger of all, of course, is that the tube be cut, or the diver faint. either case, he is in desperate straits. In If the man handling the life line "feels" anything wrong he will haul the diver up, willy-nilly, and regardless of the severe bleeding at nose and ears which will result from too rapid a rise to the surface. But it the diver be inside a wreck, or if his life line gots tangled in wreckor it his life line gets tanged in wron-age, such hauling would do no good. It is in situations like these that the slen-der connecting link of telephone wire means so much to the men who risk their lives far beneath the surface of the water. Of the deadly dangers from shark and

slender tube and a life line. Had he s sed a telephone, he will tell you, his ry might have been different, but his tion of that instrum

"It was in the Gulf of Mexico had to go down to look up the condition of the 'Bella Marta,' sunk two years be fore, and supposed to contain a a of coin. The water was only nine fathoms, and I did not expect much trouble oms, and I did not expect much retarded but I got it. I had a good man on the line, and I thought my pump was all right, yet from the first I experienced difficulty in getting air. It was found out afterward that there was a leaky it came better; then I got to work in earnest. The water was clear as a bell, and I didn't have any difficulty at all in finding the hull, although she was half covered with sand. But I had all thoughts of her seared out of me in short her rigging and wreckage to go down in the hold-dangerous thing to could not help it. I was getting along nicely, and had the hatch almost broken through, when I saw a shadow about fifteen feet long above me. I knew it was a shark, and I was a badly scared man. Of course, I commenced working my way back as soon as possible, but I wasn't quick enough. The brute saw me and same at me slowly, jaws open wide and wicked eyes gleaming like sin. And I couldn't get out, because the way I had come was the way to his jaws—he was on the wrong side for me. I was in moron the wrong side for me. I was in mor-tal terror lest he go at my tube, but he had eyes for bigger game. There was but one thing to do, so I drew my knife— luckily it was a good ten-inch blade—and waited. It was my first experience with sharks, and I was nervous; but the thought that my life depended on no one but me, kept my head clear. He came at me sudddenly, with a rush, and turned almost on his back, so as to give his solssor jaws a chance. That was my chance, and I gave it to him twice in the throat, slashing as much as I could. The water was red in a minute, and as I threw myself on my face I just prayed he would swim off to clear water. He did, I guess, because things were quiet for a while, and as soon as my heart stopp pounding long enough for me to breath. I commenced to feel my way back again through the mase of wood spars, wreckage, and old cordage through which I had crept to get at the interior of the hull. It was slow work, and hazy red as the water was, I was afraid to do much cutting of ropes for fear of cutting my own line. About this time, the air got scarce again, and I was in a desperate hurry, I tell you. I did finally manage hurry, I tell you. I did finally manage to get clear, and, all unnerved, I gave the signal to haul up, when—see this here stump of a leg? Either that shark or ar other one came along just then and go the rest of it. I hauled with all my might, and the man at the line, 'feeling' something wrong, hauled too. I came up with a rush, my helmet full of water, and nearly choked to death. The blood was coming our of ears and mouth as well as my stump, and they gave me up for dead, but I pulled around. No, never dived any more; didn't want to, either. The com pany gave me a pension, and now I just enjoy it. But that's my pet nightmarebeing tangled in a wreck, with a shark coming at me."

And for all its danger, its roms

its difficulty, the rewards of diving are not great. A hundred dollars for an not great. A hundred normal hour's diving job may seem princely than it is realized that such is jobs are few and far between, that the apparatus is expensive and the risk great, it does not seem too much. B Of the deadly dangers from shark shâ protession has this one recomming the crocodile, there are takes innumerable—dt requires comparatively lit force will selfice as typical. It is viold by and a man has many gines here who walks on a recode lag, but as a developer of electrical who were the comment in other who walks on a recode lag, but as developer of electrical who for thirty years saferantized, with wf, and contains at well as a week and wrecking gift, at the said of a few registers and an experiment. -it requires comparatively little and a man has many spare bours self to term to account in other w

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s = a Realth Food

department station at the form has livested a new a stary product entired the factle set of factle set of in a stormant condition. Metchight in a stormant condition, Metchights the theorem Russian scientist, who and the headers Russian scientist, who is the head of the Pasteur Institute Paris, says that in a considerable section old age is caused by the purpose old age is caused by the purpose of the purpose in the latest produce toric polesnas which were in beatith, old age, and finally the purpose in the purpose in the purpose in the purpose of the purpos otive microbes

In certain districts of Bulgaria, where sour milk forms the principal article of st, the people live to an old age not ed sisewhere. People in America do not take kindly to sour milk, and it was with the thought of furnishing lactic cid bacteria in a more paiatable form

The paintability of lacto is shown by an experiment carried on at Ames. Out of 179 persons who sampled lacto, 128 of 179 persons who sampled lacto, 128 pronounced it very good, 87 good, § fair, and 8 poor. Comparing it with vanilla foe cream, Ill reported that they pre-ferred lacto, 9 considered it equal to ice cream, and 59 preferred the ice cream. Comparing lacto to sherbst. 185 preferred lacto, 99 preferred sherbst, and 6 considered lacto equal to sherbst. At the college creamery both lacto and ice ream were made and sold at the same price last summer. An average of eight days sales showed that 6.8 per cent of the sales were of lacto. This is a very remarkable showing for a new product. Lacto is made of loppered whole or skim milk, with the addition of sugar, eggs, iemone, and flavoring material it contains less fat than loe cream, but more protein. It has a much higher food value cream, and 59 preferred the ice cream

protein. It has a much higher food value made at a lower cost than ice cream. It can not be so easily adulterated with gelatin, gum, or corn starch. It is more digestible than ice cream, and can be after the privy was last used, although eaten in almost any quantity without ill the infection is considerable reduced at

Freezing does not burt the lactic acid undergoes deconposition, most of the product has been stored for some time in the frozen condition Bacteriological analyses of lacto show that it I seems very probable that in three does not contain any other forms of bacteriological. does not contain any other forms of bac-teria than the lactic acid produces. This notwithstanding the fact that no especial pains were taken to keep other bacteria out of the produce, and goes to prove that lactic acid is fatal to putre-

Beating the Blizzard

W HAT is probably one of the largest VV undertakings ever begun is the establishment of an underground tele-phone conduit from Washington to New

York city.

During the last inauguration, when
Washington was in the grip of one of the worst storms experienced for many years, communication between the two cities was out off for many days. Train travel was also basty ortopied. It was during this condition of affairs that the idea of ans underton or emains that the idea of sea underground telephone conduit sys-lem was considered, which sould be oper-ated despite the most destructive storms. After conspitation with the best en-

A special cable has been manufactured for the purpose, and it is expected that when the system is placed in operation, all the business from Washington to Baltimore, Wilmington, Philadelphia and New York city will be handled through these underground wires, and any busi-ness the other side of New York will be. for the time being at any rate, by the rhead wires.

In case of accidents to the open wire plant, portions of the underground cab system can be connected to the overhead lines, enabling the company to continue its service without interruption around a break in the overhead line until the

line shall have been repaired.

It is also planned to carry, in addition to the conductors for the te ice, wires for the purpose of telegraphy, so that it seems certain that before year 1911 shall have passed the capital of the mation will be forever relieved of the possibility of isolation from the principal cities of the East.

The route of the conduit follow the most part those much traveled roads between New York and Philadelphia, then along the old Philadelphia and Baltimore turnpike, and the historic pike between Baltimore and Washington

Soil Pollution by Hookworm

S INCE the discovery by Dr. Charles Wardell Stiles that the hookworm is responsible for the low mental and physi-cal condition of the "poor whites" in many parts of the South, the problem of soil poliution has engaged the atten-tion of the United States Public Health and Marine Hospital Service as well as of local health authorities

Under the direction of Prof. Stiles and Dr. Charles R. Garduer, experiments have been conducted with a view to determining the length of time that hookworm eggs may retain their vitality in the soil under various conditions of drying and of temperature. From these exto assume that the sand under around a privy is entirely free from infection with hookworm even five months after the privy was last used, although the end of four months.

Under water, where the fecal material terial would be doad if this material is subjected to decomposition; at any rate,

it would not be safe to use such material for fertilizer in less than three months. Chloride of lime has been used as a disinfectant in solutions of about one pound to ten gallons of water. ments show that this solution does not kill all the hookworm eggs in from 22 to 40 hours.

Incidentally these experiments brought out the fact that eggs of various spe of files, including the common phoid" fly, are still capable of develop-ment, and that the flies are capable of reaching the open air, even when the fly-blown material containing the eggs

Corrosion of Iron and Steel

As a result of investigations of the
Corrosion of iron and steel, some manufacturers have been induced to produce a practically pure iron for culverts and pipes. Investigations in regard to fence wire have resulted in the improve-After consultation with the best engineers and the manufacture of specially sever machinery the plans are being out the sever machinery the plans are being out the sever machinery the plans are being out the sever machinery than plans are being out the several s



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HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT

In the following Scientific American Supplements, the well-known wereless telegraph expert, Mr. A. Frederick Collins, describes clearly and simply, without the sad of mathematics, the constructive of a 100-mile workloss telegraph outlet. Complete drawings accompany the descriptions.

- 1605-The daugn and construction of a 100-mile wireless telegraph set.
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Coasting Clocks on New York Care.— The Third Avenue Railroad of this city is about to install a number of coasting clocks on the cars of the Broadway-Forty-second Street line. The purpose of e clocks is to encourage m economise current by permitting their cars to coast as much as possible. It is believed that a saving of ten to fifteen per cent may be affected in this way. It is proposed to offer a reward for n men who make the best records, as regis tered by these clocks.

Telephone from London to St. Peters-burg.—By means of the new submarine telephone cable from Dover to Cape Gris Nez, on the French coast, and suitable iand lines, it will be possible to carry on a conversation from two ends of the wires in towns 850 miles apart, and it will be easy to speak from London to St. Petersburg. By introducing small self-induction or "loading" coils into each of the wires at spaces of about one mile apart, the defects of indistinctness and weakening of the sound noticeable in long cables of the old time have been overcome.

Electricity versus Hydraulic Power.— The Rothesay dock on the River Clyde re cently installed a complete set of electrically-driven machinery in place of the hydraulic equipment previously used comparison of the two systems shows that the cost of installation was about the same in each case, while the working power, owing to the variable character of the work. Electric power could be used in conditions that did not permit of the employment of hydraulic power When working under full load, however, the hydraulic system equaled the electric

Auto-truck to the Rescue of a Compos ing Room.—Not long ago, the city electric service of Minneapolis was interrupted by a fire This badly crippled one of the newspapers of the city, which was de pendent upon the city mains for power operate its linotype machines chanced that across the street there was a large garage, and an electric truck was hastily loaded with 105 storage battery rells used for electric vehicles. This was stationed just outside of the newspaper office, and current from the storage batteries, at 220 volts, was conducted into the composing room, permitting the operstors to continue work until the city

Losses on High Tension Lines,-In a paper read by Mr. West before the Amer-ican Institute of Electrical Engineers, the relations between voltage and losses on transmission lines, by reason of coro-nal discharge, were discussed. He found by tests on the lines of the Central Colo-rado Power Company that with tensions of 50 000 and 60 000 volts on a line 180 miles long, the loss was not serious, even though the conductor was but 289 mills in diameter. But above a critical voltage of 75,000, the loss increased greatly, particularly under no-load conditions, but this loss could be reduced by using larger conductors.

Massachusetts Board on Electrification The Massachusetts Joint Board on Met ropolitan Improvements has arrived at the conclusion that it would be inadvis-able to compel railroads entering Boston to electrify their lines. While they re-ognize the fact that electricity would add to the comfort and convenience of the public, they point out that the science is now in a state of rapid change, and that under present conditions electrification would not result in economy, although it might ultimately result in a profit. It would probably require an increase in passenger fares and freight rates. They point out that electrification is not absolutely necessary on the geometry of the faresty, and that if the reads were compelled to electrify now, they would have to postpone other more important improvements. passenger fares and freight rates. They

Rapid Tunnel Conof rapid tunnel construction of made on the Catakill aquadheading of the Walkill syphon turns which is circular and 17 feet in diamet was advanced 523 feet in a single month

Pearl Harbor Dry Dock.-The excava tion work on the big naval deydock at Pearl Harbor, Hawaiian Islands, is com-The dock is to be \$14 feet in length, 113 feet 4 inches in width at the entrance, and at mean high water it will have 32½ feet of water over the keel blocks. Pearl Harber itself, which is being improved, will be open to navigation probably late in 1912.

Rig Railway Prefits.—The report of the Interstate Commerce Commission shows that the last year was the most profitable in the history of American railways. The total profits amounted to \$940,076,363, which is nearly \$112,000,000 greater than that of the preceding coresponding period.

The Traffic Figures of the Public Service Commission.—These show that 1,526, 966,988 passengers rode on the various transportation lines in Greater New York during the year ending June 30th, 1919. The total for the previous twelve months was 1,396,086,252. The fares collected during the last year by the railroad companies reached the great total of over \$76,000,000, while the operating expense were over \$43,250,000

Curtis Turbine in British Navy. Curtis turbine has received its fir in a new British cruiser, the "Bristol," and the results have exceeded anticipa-tions. At the full power eight-hour trial, the mean power was 24,275 shai horse-power, and the mean speed on the measured mile was 26.84 knots, which constitutes the "Bristol" the fastest vesconstitutes the "Bristol" the fastest ves-sel of her class in the British navy. At full power the water consumption was 12.2 pounds per shaft horse-power per hour for the main turbines only.

Wireless on Submarines, -A most in-teresting experiment was recently carried out in the British navy, when the largest submarine, "B-1," carried on wireless communication, when in the submerged condition, with the cruiser "Bonaven-ture." The antenne were carried by a ture." yard at the top of the mast at a height of some 30 to 35 feet above the deck of the submarine, and led down to connections within the submarine. The results prove that a fleet of submarines in the sub-mergod condition could be directed from a larger ship at the surface.

Good Roads at Low Cost. - In an en-deavor to stimulate interest in the good roads movement in the States through which it operates, the Pennsylvania Railroad has issued a pamphlet entitled "Good Roads at Low Cost." The booklet de scribes the split-log drag, a device which can be made by any farmer who follows the directions given in the pamphlet, and which has been used with telling effect upon country roads. Several of these devices have been placed at various Penn-sylvania Railroad stations throughout the State of Pennsylvania

Wire Gages Should be Standardized.— A correspondent has called our attention to the fact that there are some six or eight different gages in use by the wire and sheet mills of the United States There is often a difference of two sines in the gages, and a mistake in using the wrong gage often results in a great deal of expense to one party or the other. if merely the size and not the gage is given with an order, the mill must write back to ascertain the gage, and much valuable time is lost. Our correspondent suggosts that aither themselves should get together and de cide on some one garg, or the government should take action in the matter. We commend this matter for discussion by meers, dealers, and manufactures of wire of all kinds, and of sheet metal.

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Inquiry No. 6915. - Warned machine for prost a proof shirt of machine set being bandles. Inquiry No. 6116. Wanted to buy a pe

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LISTS OF MANUFACTURERS. Inentry No. 9848.—Wanted, to buy more making sugar of milk.

for making sugar or mina.

OMMPRETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lasts compiled to order at various prices. Relimates should be obtained in advant a defendance of the compiled by the co Inquiry No. 8984. Wanted, to buy a motor driver

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Acromouties

Long Voyage by a German Dirigible.— he German military dirigible "Gross The German military dirigible "Gross III." left Berlin at 8:15 A. M. on the morning of January 21st, and landed at Gotha at 1:45 P. M. Thus in five and one half hours, the airship covered about 160 miles. En route the airship passed over Halle at 11:30 A. M. An average speed of about 28½ miles an hour, was maintained during this, the first long flight of he year by a German dirigible

Broken Propeller in Flight Fails to ause Accident.—While flying in a strong wind at Havana on the 2nd instant, Aviator Ward, of the Curtiss team, met with a mishap. His propeller broke while he was at a height of 500 feet, but he man-aged to stop his engine and glide to the ground in safety. As similar accidents have occurred to monoplanes, it does not appear that the breaking of a propeller while in flight is necessarily serious.

A Seven-passenger Flight with a Monruary 2nd), M. Le Martin, the French aviator, broke the world's record for passenger carrying by taking aloft seven passengers for a five-minute flight. Only a week ago Roger Sommer carried six passengers in his biplane. The new record, however, was made with a Bieriot monoplane, which is all the more remarkw of the fact that most of the records of this sort have been made by the biplane type of machine.

A Record Military Cross-country Flight. -Captain Bellanger, one of the best ross-country flyers of the French army, Pebruary 1st in an endeavor to fly to Pau, a distance of some 500 miles. He landed at Bordeaux at 4:56 P. M, having covered the 360 odd miles with but two stops at a rate of over 40 miles an hour. The following day he completed his flight without incident. He used a monoplane for this new record-breaking The flight from Paris to Bordeaux was first made by Bielovucci last summer in 7 hours 5 minutes actual flying time He required two days.

Experiments with Man-lifting Kites in the Navy.—On Wednesday of last week an experiment was made with man-lift-ing kites at Santa Barbara, Cal. A string of eleven kites was sent up from the deck of the warship "Pennsylvania," and made to lift Lieut. John Rodgers 400 feet in the air. Lieut. Rodgers, seated in a sling a hundred feet or more astern of th vessel, made observations and took pho-tographs during a quarter of an hour. While aloft he signaled to the officers or the warship, and gave them the re of his observations. This is the first time that tests of man-lifting kites have been made by officers of our navy. The "Pennsylvania" was traveling at a sp of 12 knots against an 8-knot breeze during the experiment.

Herding Cattle by Aeroplane. — The uses of the aeroplane are becoming more numerous every day, but novel indeed is the use to which his Bleriot monoples. was put by M. René Simon at Houston, Texas, on the 27th ultimo, the opening day of the engagement there of the interna-tional aviators. M. Simon flew out over the plains, and rounded up a large num paints, and rounded up a large number of steers by circling above them and swooping down upon them. When he had got the herd together, he succeeded in driving them right up to the fence of the aviation field by employing similar tactics. The cowboys looked on in amagent, and upon his stickies. ment, and upon his alighting, they thanked Simon for having so cleverly and expeditiously herded the cattle. The following day, at the Houston meet, M. Soliowing day, at the Houston meet, M. Inferior nourishing qualities of the Soliowing day, at the Houston meet, M. Inferior nourishing qualities of the white Soliom Gerroe ascended to a height of bread commonly sold we urge inguistion 1,000 feet, and was lost in the clouds for making it compulsory that all bread solgations, principles. M. Simon less over the asuch should be made of unadularisted generators in the grand stand only five up wheat four, containing at least eight per high parts them—ocloses indeed, (agi, can of whole wheat, including the germ 1,000 making for many over blown of.)

The Flowing of Metala.—It is perhaps not generally known that one of the most important properties of metals employed in striking coins and medals, and stamping and shaping articles of jewelry, is that of flowing under pre-sures franched editors, resembly the preure. Standard silver is remarkable for this property, which precisely resembles the flowing of a viscous fluid The flow takes place when the metal is subjected to rolling, stamping, or hammering, and to rolling, stamping, or hammering, and the particles of the metal are thus car ried into the sunken parts of the die without fracturing, and a perfect im-pression is produced.

Good "Seeing" at Lick.—The excel-lence of the Lick telescope and the steadiness of the air when the conditions are good on Mount Hamilton are attested by the statement of one of the observers there, that double stars, whose components are nearly equal in brightness can be measured if the distance between can be measured it the distance between them exceeds one-tenth of a second of arc. What this means in accuracy of definition may be understood by remem-bering the fact that one-tenth of a sec-ond is equal to the apparent diameter of the head of an ordinary pin, viewed by the maked eye—if the eye could see it—at a distance of two miles.

Science of Colonizing. -Of all the colon izing powers. Germany makes the mos through study of the physical conditions prevailing in her possessions, and espe-cially of that all-important factor in colonial problems, climate. To the long series of climatographic memoirs hereto-and is issued by the Royal S Göttingen, which has maintained a large Gottingen, which has maintained a large observatory in Apia since 1902, under the direction of which a reseas of meteorological stations has been in operation throughout the islands.

Charcot Indorses Peary.—Dr. Jean Charcot, the French Arctic explorer, has come out strongly for Peary. In a rather passionately written monograph he asks why the French have failed to accord Peary honors which have been showered upon the American explorer by almost every other country. "Is it," he asks, "that because in France geography is generally ignored, and that, for the sake of hiding our ignorance, there is an endeavor to produce the impression of a greater knowledge than that possessed by others? Or is it from jealousy, because we are the nation which has made the least effort toward the conquest of polar mysteries? We owe it to our country, al-ways so keenly hungry for justice, to settle this matter aright. All France, enthusiastic as it is over acts of heroism without distinction of nationality, owe it to itself to repair one of the greatest pieces of injustice of the century!

Standardising Bread,—Sir Alfred Fripp, Surgeon in Ordinary to the King of England, and some other equally eminent British medical authorities, have issued a jointly signed statement in which they express the opinion that there is a mational necessity for the fixing of the nutritive value of what is sold as bread They argue that milk must conform with a certain standard, and there seems to be no reason why bread, which is equally important as a food, should not be made important as a food, should not be made the subject of governmental control. In-deed, the standardization of bread is somewhat more important, since it con-stitutes about two-fifths of the weight of the food of the working classes. To quote the statement: "In view of the



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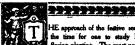
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Annual Horticultural Number of

American Homes and Gardens

for March



the time for one to study his plan for the Charles Downing Lay, the well-known landscape a full pages have been given to the subject, which range ing of trees, shrubs and flowers, to th growing or these, and as any access to the last service to the sa and a guide in planning and planting for this season's we addition, the issue will be full of helpful and timely stage. ared by experts who have devoted their time and best

The March number will be published on February twentieth. Copies may be obtained from the newsdealers of from the publishers, price topenty-first and

BURN & COMPANY, E. (P. Prop.)

CEMENT

The MARCH MAGAZINE NUMBER of the SCIENTIFIC AMERICAN ISSUE of MARCH 18th. 1911

The Scientific American opened the new year with promises to its subscribers and friends, of larger issues and of mid-month numbers embellished with colored covers and composed not only of the regular material appearing in the Scientific American, but of material relating to some special topic as well.

With this issue, we inaugurate the first of the promised monthly magazine numbers, in this instance a number partly devoted to those scientific aspects of modern agriculture which show that the farmer is reaching out from his ancient calling of merely tilling the soil in a haphazard way, into the higher spheres of chemistry, physics and bacteriology.

The March Magazine

Tellowing this plan, the next mid-month number, which will bear the date of March 18, will embody the regular features of the Scientific American, and, in addition, a remarkable and highly instructive series of articles on the use of cement. We cannot but feel that in no popular magazine has there ever been gathered together a series of articles on the uses of cement which drive home so tellingly the wonderful versatility of a substance, at once one of the oldest and the newest of architectural materials.

The Every article is written by a man who has actually worked in the field which he is describing, and who is, therefore, able to express himself authoritatively on the results achieved.

WHAT THE NUMBER WILL CONTAIN

The Manufacture of Cement

The Manufacture of Centeria

If int of all, there will be an explanatory article, something in a pedagogic strain, so simply worded, however, that a reader who really wishes to learn cannot fail to understand the message written. That article will answer the question "What is Portland cement?" In addition, it will answer the questions "Why is it called Portland cement?" "How is it made?" Mr. E. D. rortund cement?" How is it made?" Mr. E. D. Boyer, a leading cement expert, is the author of the article learning transports you into a cement factory, takes you by the hand and guides you through the plant, and above, step by step, the processes through which raw rock must puss before you can buy it in the form of a barrel of cement.

Cement in Ancient and Modern Times

I Like many a new invention, Portland cement is as a last civilization. It remained for the modern engineer and articlate to develop the substance to its highest pitch of perfection. Mr. Albert Moyer will contrast the accient with the modern use of coment, and show the wonderful adaptability and the modern use of coment, and show the wonderful adaptability and the modern use of coment, and show the wonderful adaptability and the modern use of coment, and show the wonderful adaptability and the modern use of the

The Mimicry of Cement

The beathing of Celment

When the ordinary comend block first came into being, its ugly, uninteresting gray surface channed it in the eyes of the artistic. Nowadays
we know how to color coment, so that it can assume almost any shade
closired, and so that it can duplicate the texture of different colored granites
and other stones. This phase of the subject is ably treated by Mr. Fred
Noris, a leading export it such work.

The One-Piece House

Much has been written of late in magazines and Much has been written of late in magazines and newspapers on the subject of the monolathic cement house. The story of the amazing achievement of casting a house simply by pumping into special forms liquid material which later becomes as hard as stone, has never been fully told. Mr. J. P. H. Perry, who has built house after house on this new plan, will explain the progress that has been made in this method of building. What is more, he will tiell you how far the method is practicable in the light of our present knowledge of cement. There will also be descriptions of other systems of house building with portable forms.

The Problem of Waterproofing

There are many who hesistate to employ Portland comen because someone told them it was impossible to make a cement house waterproof. It cannot be denied that a difficulty exists. Yet the principal and practically that the construction of foundations which will prevent the seepage of moisture through concrete walls into cellars. Just what should be done to waterproof the foundation cellar walls in fully set forth by Mr. Ralph Davison, an expert in waterproofing materials. He gives detailed and practical examples to cover all the situations that may arms.

The Relation of Cost to Supply

In addition to the contributions enumerated, there will be a statistical article which will graphically compare the increase in the use of cement and the corresponding decrease in the price of cement.

REGULAR SCIENTIFIC AMERICAN FEATURES

All these articles, and others which we hope to publish on the subject of cement, will appear as an addition to the regular Scientific American. There will, for instance, be the usual Aviation page, the abstracts from current periodicals, the Inventor's Department, and those articles which discuss the scientific achievements of the hour and which would naturally find a place in the Scientific American as soon as they are announced.

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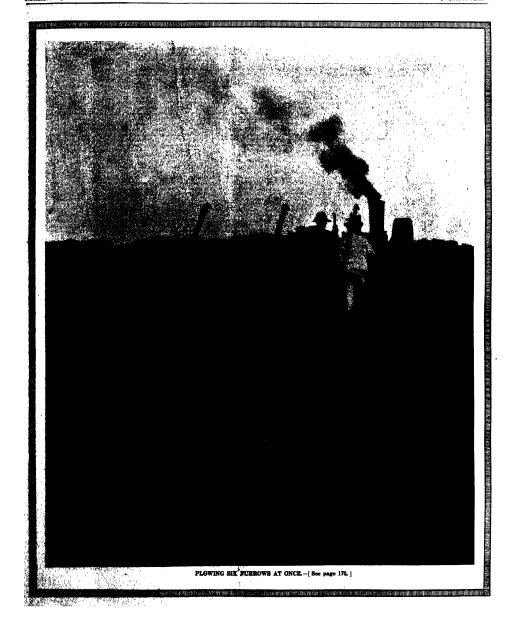
SCENTIFICAMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination dijustrated are rannor is always goal to receive for examination illustrated Articles on subjects of timely interest. If the photographs are sharp, the articles shart and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at

The purpose of this journal is to record accurately and in simple terms, the world's progres in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

The New Stars

HE new stars which have been recently dis-covered in Sagittarius, Ara, and Lacerta have eovered in Sagittarius, Ara, and Lacerta have once more attracted attention to a class of bodies which for ages have puzzled attronomers and which, of late years, have been intimately con-nected with nebular and other cosmogonical hypo-theses. In astronomical annals the blasting forth of a new star in sudden magnificence has been the start of the same of some attronomer who later linked with the name of some astronomer who later became famous.

Thus, the appearance in 184 B. C. of a new star in the Scorpion suggested to Hipparchus the conastruction of a new catalogue of stars, which, with alight alterations, remained the standard for nearly sixteen centuries and which led to the notable dis-covery that some of the so-called fixed stars are in

motion.

The appearance of a remarkably brilliant star in the constellation Cassiopeia in November, 1972, aerved the purpose of reviving Tycho's waning interest in astronomy, prompted him to apply a variety of methods to the new body for the purpose of accertaning whether it had any perceptible parallax, and led him to conclude that the mysterious orb must belong to the region of fixed stars—to us a rather insignificant deduction, but at that time of vast importance in view of the generally main-tained Aristotlean doctrine that the heavens generally, and the regions of the fixed stars in particular, were incorruptible and unchangeable, and that new stars, like comets, must belong to the higher regions of our own atmosphere. The work which he wrote on that body later induced Kepler to remark: "If that star did nothing else, at least it announced and

produced a great astronomer."

Tycho's star must have been a body of astonishing splender. He tells us that the star was seen by some at monday, that it declined after a few weeks, and disappeared allogether in sixteen months. So exact are the measurements that he made that the telescope can be directed to the precise spot where he waw his matchless orb; but no such star as he described is there to be seen. It has been suspected by some astronomers that a tenth magnitude star, situated not far from the position indicated by Ty cho, may be his lost nova.

The fitful gleaning of a new star was the occasion of Galilei's first contribution to astronomical discovery; for the star that flared up in 1604 in the constellation Serpentarius was shown by him to be constellation Serpentarius was shown by him to be at any rate more distant than the planets, a result confirming Tyeho's conclusions that changes take place in the celestial regions even beyond the plan-ets and are by no means confined, as was commonly supposed, to the earth and its immediate surround-ings. In his great astronomical treative "Dialogue of the Two Chief Systems of the World, the Ptalic-male and Coppernican," his character Salviati bases some of his most potent arguments for the sceept

ance of the Coppernican theory on new stars.

The same body moved the great Kapler, who stands perhaps second to Newton in the persever-ance and ingenuity which he displayed in solving the riddles of the universe, to write two pamphlets on its vagaries.

In later times, nove engaged the attention of Herschel in his attempts to estimate the relative distances of stars from the earth, their arrangement in space, the variability of their light, and their magnitude.

The new star that blazed wonderfully in the constellation Perseus on February 22, 1901, and was first seen by the Scotch astronomer Anderson, is the nrst seen by the Scotch astronomer Anderson, is the only body at all comparable in splendor with that of Tycho. In rosy tint was curlously like that of the recently discovered Nova barctae. The new star in Perseus grew brighter and brighter, faded, and then regained something of its former brilliancy. Thus it fluctuated in brilliance with nobrilliance in brilliance with no-ticeable regularity. So inexpressibly distant is the constellation Perseus that the light of its stars, flashed through space at a speed of 186,000 miles a second, reaches this earth only after a lapse of 120 second, reactives this earth only after a lapse of 180 years. What Anderson discovered, therefore, was a light that suddenly flared up in 1781, while the American colonies were still fighting for independence. And so the new stars which have been recently discovered belong, not to our own day and generation, but to a time when there were no railroads, telegraphs, telephones or steamboats.

What are these mysterious bodies? It would be

rash indeed to dogmatize. The spectroscope has re-vealed the secrets of their composition, and has linked them in chemical kinship with nebulæ. Indeed, the opinion is fast gaining ground that there is some intimate physical relation between novæ and nebulæ. Arrhenius, in his remarkable cosmogony, "Das Werden der Welten," has done much to further that view. What Anderson saw in Perseus, Tycho in Cassiopeia, and astronomers of our own day in Sagittarius and Lacerta, are to him superb He draws a vivid picture of two giant cataclysms. He draws a vivid picture of two gnamsuns, childed to black cinders, but still imprasoning within their frozen shells a fierce heat and compounds of terrific explosive energy, crashing together in a celestial head-on collision. When that catastrophe occurred, each dead sun was rushing through space at the rate of 400 miles a secon faster by seven hundred times than a projectile fired from a modern 12-inch gun. Two enormous bodies, traveling at such frightful speed, cannot be suddonly arrested without in some way disposing of their energy. Part of this energy is converted into a heat intense that the fragments of the two she suns glow with a dazzling light. The remainder of the energy, according to Arrhenius, is spent in twisting the fragments around a common center at a speed of hundreds of miles a second, so that a huge spiral nebula is created, examples of which we find in Canes Venatici, Ursa Major, and the Triangle.

In that spiral nebula, Arrhenius sees the birth of a new solar system, or at least a world—not a reckbound, sea-swept world such as ours, but a glowing chaotic mass. Gases and fine dust compose the spiral streams; and the dust, gathered in great re-volving clouds, is periodically interposed between the carth and the star, thus causing those more or less regular obscurations which are characteristic of many new stars. Continuing his mechanical argu-ments, Arrhenius points out that the effect of this ments, Arrhenius points out that the effect of this revolution on the mass of gas and dust is to produce a flat disk, intensely hot and dense at the center, extremely attenuated and cold at the resort outer edge. After the lapse of ages, he sees the spiral formation gradually obliterated by the action of gravitation and of other forces. He points to nebulse for evidence of these mysterious processes, and regards them as the products of dust and gases thrown out by colliding dead sums. Out of these nebulæ planetary systems will be evolved by the age-long process of standy contraction and by the clustering of matter through attraction into globes, which will evidence of these mysterious processes, and re-

No astronomer would be rash enough to accept this theory unhesitatingly. Astronomy is still in its infancy. Century after century must clapse before we can detect even the slightest change which would serve to confirm any such doctrine of stellar evolution. And century after century must clapse b tion. And century after contury must clapse before other observations can be made and compared with the original observations and with observations made in our own and historic times to justify one in assuming that new stars and nebulæ are indeed the stuff of which solar systems are made. Speculations such as tness are activities to a large extent, but they show that the moders physicist care frame scientific epies of true Homerle grandeur.

An Enumple in Tarkine Steams Constitution of the question of efficiency, and adaptivelity of the steam turbine, as compared with reciporating engines, for marine use, his in the just received much attention. The problem of the turbine received much accusum. It protects to the carestic steamship has now passed for beyond the experi-mental stage, a considerable number of our largest teamships being to-day equipped with powerful ar-bine engines. But this branch of marine engineering bine engines. But this branch of marine engineering is still very young, and every contribution to the knowledge of the theory and practice of the turbine steamer must be welcomed by all interested. In this connection a paper recently presented to the Society of Naval Architects and Marine Engineers by C. H. Crane deserves our attention. It relates to the rebuilding of the steam yacht 'Vanadis,' "a beat which was originally equipped with Parsons turbines with high-pressure enter and two lew-pressures divising. high-pressure center and two low-pressures driving the wing screws. The boat was delivered by the the wing screws. The boat was delivered by the builders with a guaranteed consumption of 36 tons of coal per 36 hours at cruising speed of 18 knots. The owner, however, found that the engines were consuming coal much in excess of the guaranteed amount. So serious was the discrepancy between the guaranteed and the actual figures, that he bunker capacity was quite inadequate to hold the amount of coal required for a run of normal length. An ex-haustive test was therefore made, from which it was seen that the actual coal countmyption was 35 tons, seen that the actual coal consumption was SS tons, i. c., 87 per cent. in excess of the guarantee. The problem then arose as to what could be done to remedy the existing defects. Three ways seemed to be open out of the difficulty. The vessel might be lengthened, or the turbines might be entirely replaced by twin reciprocating engines. Lastly, the high-pressure turbine might be replaced by a recipro-cating engine, exhausting into the two low-pressure wheels. The last was the expedient actually emwheels. The last was the expedient actually employed. The operation proved an entire success, the coal consumption falling to 22.5 tons, i. e., considerably below the figure of the original guarantee, at a speed of 18.5 knots. Recomputed on a basis of

We have here an interesting example of the use of the low-pressure turbine for the economical utilis-ation of that end portion of the steam expansion which cannot, in the reciprocating engine, be profit-ably utilised. The steam turbine is particularly adapted for work under these conditions, and by the happy combination of the two types of engine, the builders finally found themselves in a position, not only to fulfill their guarantee, but to present their client with a small extension of the cruising radius.

Seeing Things at Night

Many people have wondered why, in a dim light, familiar objects are apt to assume fantastic and frequently alarming appearances. The scientists asy that the explanation is to be found in the special conditions of night vision. The pupils are widely dilated and, as in the photographic lens with a large diaphragm, the apparatus of accommodation can focus only for the plane. As the faculty of estimating distances is in great measure lost in the obscurity, we cannot focus with precision, and a blurred uncertain outline is thrown upon the retina.

line is thrown upon the retina.

Then, too, colors viewed in a fading light lose their distinguishing hue in a fixed sequence until a point is reached at which everything becomes of

a point is reached at which everything becomes of one uniform gray that.

The images that are transmitted to the visual eventeer are, therefore, profoundly modified in color and outline; and as they enter the eye through the widely dilated pupil at an altogether unusual angle, the movement of loconistion gives them a peculiar the move

Now, one relies on experience for the in Now, one rebies on experience for the interpreta-tion of sensorial impressions; and when these pre-sent themselves suddenly in an unusual form, they create a feeling of insecurity that finds expression in mental perturbation and more or less violent moter impulsion. In fact, the subject shad himself in the position of a horse that sees a rapidly ap-proaching sutomobile for the first time, and does not know what "to make of it."

Imagination aiding, these burred, mobile, and uncertain images are succeptible of the most phan-tamenation interpretations, and in presense who are

uncertain images are succeptible of the most phan-chanagardic laterpretations, and in presents who are not accustomed to control sensorial impressions are secrepted as realities, and acted upon accordingly. Men who, are accustomed to night work in, the fields make allowance for phenomena of this obies, and convect the visual deficiently by the sid of other sensors, such as hearing, which are not dependent on

The state of the s

Svante August Arrhenius

The Founder of the Theory of Electrolytic Dissociation

By Professor Wilhelm Ostwald

S VANTE AUGUST ARRHENIUS was born February 19th, 1859, near Upsala. His ancestors were farm-ers, and the name Arrhenius is a Latinized derivative of groun, meaning a river bank, the name of the family estate in the south of Sweden. His father was superintendent of grounds of the University of Upsala At school Swante ex-

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hibited remarkable himself particularly in mathematics, physics and biology. He entered the University of Upsala in 1876, but in 1881 went to Prof. Edlund in Stock-Ediund in Stock-holm. He attsined the degree of doctor of physics in 1884 His graduation the-sis, "A Study of the Conductivity of Electrolytes," published in the same year, made a profound im-

pression upon me.
I have devoted part of my life to the study of the chemical relation between when that paper appeared, I had ob-tained for the speaffinities various acids values closely agreeing with the results which Arrhenius had reached by a very different road. The method by which Ar-rhenius had attacked and partly solved the problem was far more comprehensive and fertile than my own. I was then connected with the polytechnical school of Riga. Russia, and there I repeated and extended the experiments by which Ar-rhenius had proved the enprovimente proportionality of the chemical affinities of their electrolytical conductivities, and published the results. Then I went to Upsala to support Arrhenius whose views were regarded as he-terodox, in obtaining a position in the university. A year later we worked to-gether for several months at Riga.

1887 Arrhenius published his theory of electrolytic disso cistion, probably the

most important and prolific of his many achievements. which explained the observed anomalies in the free ing point of electrolytes and interpreted as a dissoion factor the irrational coefficient (V-1) in Van't clation factor the irrational coefficient (V=1) in Van't Hoff's them new and much discussed theory of samicle pressures. The new theory of electrolysis rapidly de-veloped, explaining many well known but little under-steed phenomena of classical equilibrium, analytical reactions, the concentration of stactrolytes, the gal-vanies better, the solubility of games, etc. (This rapid success spines arrhenium the waste of energy in polesmics which the ionocclast insuity suf-thers, and then have the means of support and of further attention and the interface of the control of the further attention and the interface of the control of the con-

entific activity. In 1891 he was entired to

AND SALABORE TO THE SALABORE

his subsequent promotion to a professorship was due mainly to the influence of foreign scientists. In 1897, however, his colleagues chose him as their rec tor, or president, and he was twice re-elected to this position, which he finally declined in the interest of

a position in the new University of Stockholm, where

German and British colleagues in this line of research Arrhenius published a great many papers in the ten years that followed the announcement of the dissociation theory. In the succeeding decade his duties as rector of the new university, to which he devoted himself with great diligence and success, diminished

his scientific output, but two new and very important phases of his activity belong to this period

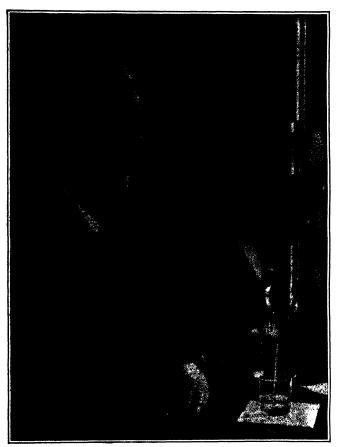
In connection with his early studies of the conductivity of solutions he had investigated electric conduction in silver chloride in light and in darkness, in phos-phorescent and illuminated air, and in Bunsen flames in which various salts were vaporized. 1888 he studied the influence of the sun's rays on the electrical state the atmosphere 1895-8, in collabora-tion with Ekholm, he published rescarches on the auroras, thunder-storms and terrestrial electricity, the 26-day period of thunderstorms and auroras, and the effect produced on the earth's temperature by the carbon diox-ide of the atmos-In 1898, also, appeared his remarkable paper on the effect of cosmical influences upon tions, which has an parently been over-looked by revent studente of portodic vi-

In 1905 be asion-ished the scientific world with his twovolume Text Book of Cosmical Physics, containing many bold and original ideas in regard to constitution and origin of the heavenly bodies Still more recently appeared "Worlds in the Making." which exhibits in a striking man-ner the author's characteristic truits, independence and startling boldness conception, the abili-

ently disconnected facts from a common viewpoint, and a masterly simplicity and comprehensiveness of result and statement.

The most striking novelty in the cosmogony of Arrhenius is the introduction of the pressure of radiation, which appears to be a very active factor, not only in the formation of comets' talls, but also in many more important cosmical processes

Arrhenius has recently taken up the study of serum-therapy and has explained Ehrlich's important discoveries by a theory of unsaturated compounds, analogous to that which exists between weak acids and bases.—Adapted from an article published in "Die Forderung des Tages," Leipzig, 1910. Akademische Verlagagesellschaft, m. b. H.



Junte Archeine

his scientific work. In 1905 he became director of the The theory of electrolytic dissociation soon gained

o many enthusiastic young advocates that it continued to develop without direct aid from the founder, except where such aid was required to refute criticism and enlighten skeptics. In 1890 Arrhenius, Van't Hoff and I were invited to discuss the theory of solu-tion with a committee of the British Association, the members of which were at least partially converted to the new views by their foreign guests, sided by William Ramssy. The new theory made rapid pro-gress against strong opposition in Great Britain. French chemists refused to discuss or consider the theory at that time and they are still far behind their

The Necessity of Longer Piers for the Port of New York

Advantages of Extending Pierhead Lines Stated and Objections Answered

By Calvin Tomkins, Commissioner of Docks, City of New York

COMMISSIONER TOMEINS has recently made an Cerhaustive study of the problem of handling the rapidly growing water-borne freight and passenger traffic at New York; and his report contains a masturly plan, relieving the present congestion and taking care of the inevitable growth of the future. The Commissioner believes that, if the subject of extending the piers farther into the Hudson River be considered on the broadest grounds, st will be found that the interests of the nation, the State, the city and the steamship companies would alike be furthered by such extension.—Eurros |

e application of the International Mercantile Marine, the Compagnie Generale Transatiantique, and Cunard

Steamship companies affords an opportunity discussing the rethe pierhead lines on both sides of the Hudson River above the bay within the port of New York

The interest of the city in this matter is identi-ral with that of the general government and the entire p including both the New York and New Jersey sections; and it is Important that ew Jersey interests shall receive the same exhaustive and consider ate attention as those of New York.

The trade and commerce of the city will for the time being be ser iously affected. inexpedient lengthen these piers. The city does not wish, however, to pre judice the future interests of the any change e to mect merely temporary conditions, how ever existent

The two States New Jersey and New York, togeth with the Fed eral government,

are jointly charged with the responsibility of fitting the physical plan of this, the greatest seanort of the world, to the expanding needs of its commerce. The city enters into this discussion unprejudiced and with out bias of special interest, desiring only that the conclusion reached shall be the best and most comprehensive decision now attainable

It is plain that the interests of the port will best be served by permitting ships to dock where they find it most convenient to receive and discharge passengers and cargo. New York is the great port for partial cargoes. Express freight and passenger steamers of the first class maintain liner service from here to the principal European ports; and second class passenger and bulk freight liner service is maintained to the other large ports of the world. Rallroads and coast wise steamship lines converge at New York for the se of connecting with the liners centering here The high-class and package freight business seeks terminate at Manhattan, since this class of freight is, for the most part, destined for Manhattan, and if landed at South Brooklyn it will necessitate transfer by lighter or truck to this borough. Passengers and

their luggage can also be cared for more expeditiously. conveniently and economically here than elsewhere. The same reasons which impelled the Pennsylvania Railroad Company to establish its terminal here compel the great steamship companies to seek Manhattan dockage, since it is most convenient to hetels, rairoad lines, amusements and wholesale and retail business. The passenger business has developed to unprecedented proportions within the last ten years, and most of the passengers who land at Manhattan spend some time and money in the city In the aggregate this business is of the greatest advantage to the community and to the country at large. The fact that it is more convenient and economical to utilize deeper and longer

impelled the Pennsylvania

line at Pier 1, and northward in a straight line to a point 100 feet outshore from Pier 71 at the foot of Weet 31st Street; thence parallel with the present pierhead line 100 feet outshore to a point approximately op-posite West 90th Street. This extended line is shown on the map which I submit herewith. It is not necess sary, however, that the line should at present be ex-tended north of 81st Street. The city can coincidently arrange for additional pier lengths in the new district

THE RESERVE OF THE PROPERTY OF

PROPOSED EXTENSION. If practicable, the city desires that the pierhead line may be extended 100 feet outshore from the present ends of the Cheisea piers and continued southward to

the Battery, becoming coincident with the present pie line at Pier 1, and northward in a straight line to a

> part of the river is opposite the the river is wider. The extension be-low the Chelsea district would straighten the straighten the pierhead line and permit of pier lengths up to 1,100 er length be needed, it can be ob-tained by laying ships alongside of quays above 72d Street, or by providing diagon-al piers similar to those of the New York Cen-tral Railroad Company in the West 60th Street section Such piers, however, cannot at present be obtained in the lower districts without great inconveni-

between West

42d streets and

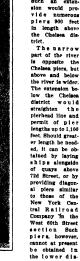
between West 44th and West 50th streets by

excavating 75 or

shown in the map

as reproduced or our illustration. Such an exten-

100 feet within the established bulkhead line of 1871. This is not





THE PROPOSED EXTENSION OF THE PIER-LINE IN THE PORT OF NEW YORK

vessels than formerly should not be permitted to count against the city's interests; and if this class of ships cannot dock at Manhattan as heretofore, the resultant injury to the city's trade will be serious indeed. This is the fundamental reason for desiring such reasonable pler extensions as can be made without prejudice to the permanent interests of the port

The "Titanic" and "Olympic" will soon be ready and

will arrive at New York in the near future will arrive at New York in the near future. Other whips of even larger size are under way, and suitable berths must be provided for them. There are only a few great ports in the world between which ships of this kind can run, and it is of the highest importance that the most convenient terminal facilities possible should be provided for them here; otherwise New York will be at a disadvantage with the other sea ports at which the commerce of the world is concentrating. At present the Chelsea piers are too short, and the

storms of the new vessels, carrying the propellers and rudder, the most vital parts of the ship, will be ex-posed to accident. There are no dry docks here large enough to make repairs, and damage to the parts in question might entail very serious cons

ence and expense, incident to the rearrangement and tensively used.

OBJECTIONS

Three objections may be cited to such an extension of the pierhead lines:

That it will interfere with the currents and with the tidal prism.

oust be considered in connection with comprehensive adjustment of the pierhead line in

3. That it will unduly narrow the fairway.

3. That it will unduly narrow the fairway, in answer to the first objection I submit herewise profile of the river between the New Jurnity as the New York shores, showing that by examples the Onlines district the city added dis gar, out of the cross profiled of the river. Therefore, Salver, End Street, Which it, will be subtimated major systems and Street, which it, will be subtimated major systems and their district shows the considerable of the contempts that the latest salve maps a have been or will be adversary, effected, in answer to the second objection. I respect of the second objection. I respect of the second objection. I respect of the second objection.

Some Recent French Monoplanes

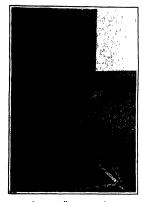
Details of Several New Machines

THE accompanying photographs of some of the latest French monoplanes are instructive as showing the trend of design and construction in France. The most invent of design and construction in France. The most motable at the machines illustrated, the Robert Esnault Patterle (Z. E. P.) monoplanes, is well known to our readers, not perhaps in the late form herewith shown, but in its general design, which appears to have been changed only in details. The Pottle monoplane made and the state of the monoplane and the state of the state of the monoplane and the state of the state

than the wires or steel bands to which they are attached. Care should be taken to see that the section of metal at the root of the threads is fully equal to the section of the metal in the connecting rods or wires.

This latest Pelterie model shows how greatly steel tubular construction is growing in favor ers. The body frame is of steel tubing, as are also the frames of the tail and the horizontal and vertical rudders. These latter, as will be seen from our it will be seen from our il lustration, offer a good ex ample of careful and neat design and workmanship The tail consists of two triangular, horizontal sur faces at the rear to which are hinged the two sec-tions of the elevating rudder. The vertical rud der also is in two parts, carried one above and one below the tail, and upon a broad skid of bent wood is mounted immediately low the vertical rudder and at the extreme end of the tail.

The new R. E. P. monoplanes have been considerably simplified and improved, and they have shown themselves to be very speedy machines. They are provided with a 7-cyl inder air-cooled motor of 50 to 60 horse-power. The



A new propeller on a monoplane.

This propeller recalls the "stick of wood" with which Curtiss wou the first Gardon Bennett race

cylinders of this motor are in two planes, and are spread out like a fan. The engine is constructed along the same lines as heretofore, but it has been enlarged

On the last day of the old year, an aviator named Pierre Marie, in competition for the Made in Triangle remained aloft six hours and twenty nine minutes in his R E P monoplane, covering the chandred and fortwome unite in a continuous flight I that his fuel not given out, there is a strong probability that he would have won the Mitchell prize. He holes all speed records beyond one hundred and fifty mills, his average speed for the total distance being at the high rate of fifty-three miles an hour. The above perform ances show that the new Petere monoplane is one of the fastest and best of the new French single surface machines.

Another case of steel tubular construction is seen in the Newport monoplane, the full and double rudders of whith, together with one of the wings are shown in one of our Illustrations. The rudder is of the compound tipe with two vertical and one single horizontal surface, the whole rudder having a larger, the whole rudder having a wreast movement controlled by white leads. This is the machine in which the Ill fated Lleut Caumont is Prore fell to his death on December 30th last

The Kaufmann makhine is built, as will be seen from our illustration, from the general design of the Stantos Dumont Themsiosile" monoplane. There are the same short and deep wings, and the same low center of arxivit, the operator being seared but a few inches above the ground—a position of extreme peril in case of a fall or to rapid landing. The antequards against a smashup in landing, however, seem to be prefix well worked out, the greater part of the load being taken on a pair of wheels carried in a tubular spring-controlled framework, while

trolled framework, while forward there is a projecting shoe carrying a pair of small landing wheels, and aft, under the tail, is a privoted skid controlled by heavy rubber bands

An unusual feature, the reason for which is not apparent, is the great depth of the leading edge of the planes, there being nothing, as far as we know, in the dynamics of flight to warrant putting on the under side of the plane the big heavy buge noticeable in the photographs

The unusual design of propeller which is shown on a monoplaine, is said to have given good results in experimental flights. It will be seen that the projected with of the blades is uniform over their entire length. The theory of this propeller is that by engaging the said over a surface of uniform width, higher efficiency is obtained. It is claimed by the designer of this propeller -31 Raymond Petit—that as serve of this type 5½ feet in diameter gives more thrust than one of T¼ feet diameter. The propeller is known as the R. I. P.

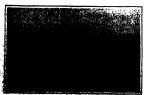


The Kaufmann monopiane -- a machine with peculiarly shaped wings along the lines of Santas Dument's Demolecile.





Details of the tail of the Nieuport machine.







A STATE OF THE STA



Landing skid and chassis of R. E. P. monoplane.

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

The Harm Done by the "Harmless" House-fly

THE common house-fly, the Musca domestica of Linnaus, that insect which figures in fable and poetry, and is popularly regarded as a harmless, innolively and interesting creature, which may be looked upon with indifference, or at most struck at with objurgation when too familiar, proves to be one of our worst enemies. Its relations to human life and sanitation are most important, and yet for years all efforts to bring the facts of its noxious existence prop-erly to the attention of municipal authorities met with indifference or ridicule

In a striking article published in the National Geo-graphic Maguzine by Mr N A Cobb, accompanied by

These germs may be brought to us from some sick per-These germs may be brought to us from some sick per-son by whatever is large enough to carry them and has the opportunity. Combine this fact with what every one knows about files, and we see at once the tremendous importance of files as carriers of human disease germs.

"The result of this simple piece of reasoning is startling that it is often sidetracked by its own im-portance. It looks so incredible that we hesitate, dis-trusting our own logic. It seems incredible that men have gone on doing as they have done, and as they are still doing, if the facts are as they seem. The consequences of our reasoning seem so tremendous, we fear there must have been a mistake somewhere. And so we dismiss the idea.

One way to disturb this false security is to interest

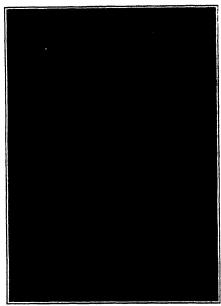
the sum of all the small weights is considerable.

"Now, remove the weights and attach all of them to one or two of the threads at one end. The plaster will premptly be torn loose. Acting on a portion of the plaster at a time, the weights can accomplish what they cannot accomplish when distributed along the whole surface of the plaster.
"This experiment illustrates roughly how the fly

uses and controls its feet. Of course, in my illustra-tion you can see just how the weights release the plaster from end to end. It is very difficult to make plaster from end to send. It is very united to masses, this observation on a fig, because the fig's pad is so small, and more particularly because the whole oper-ation takes place in semething like the fiftieth part of a second.

a second.
"Wonderful as the fly's pads are, they have their





rapha by N. A. Cobb. Copyright 1910 by the National Ge

Male house-fly resting on glass and seen from below.

Front view of the head of a house-fiv. The fly is one of the most highly organised of insects. The two large areas studded with thousands of facets are the compound eyes. The three simple eyes are seen at the top of the head in the middle.

In addition to two claws, each of the six feet is supplied with two light colored sticky pads. Germs and spores stick to these pad- and are thus carried from place to place with great rapidity,

photographs made especially for that article by Mr. Cobb, the menace of the house-fly is instructively discussed

"The fly's power to spread disease." says Mr. Cobb. "is a direct function of its powers of locomoti can fly considerable distances at a high rate of speed. It is quickly carried long distances by trains, boats, teams, animals, and man

HOW THE FLY PEST SPREADS.

"It is possible to get a good idea of a fly's rate of flight in a number of ways. Files come to ships newly arrived in port across considerable stretches of water This we know, because a few hours earlier there were no flies on the ship. No communication has been had with land. The files must have come on their own wings Occasionally we see a fly follow a team or animal, casily keeping up a good pace. The wing wings Occasionally we see a my ronow a ream of much cash, keeping up a good pace. The wing muscles of a my when weighed are found heavior in, proportion than those of any brid to far examined. It is diffiguit to tire a my out. Test this by trying to keep ofthe constantly on the wing in a room and you will soon, find you have no easy task. All this shows will soon find you have no easy task. All this shows the fly to be no mean navigator of the air. "Most of our diseases are caused by favisible germs

people in the habits and structure of files. The more we know about flies, the more clear it will become that they are among our worst enemies.

THE ANATOMY OF A FLY.

"The photographs illustrating this article have been designed with this end in view. Take for instance the view of the fly resting on glass and viewed from the view of the my resting on glass and viewed from below. Look at the feet, and observe that each of them has two claws and two light-colored pads. This yielings to rough surfaces by means of the claws, and to smooth surfaces by a combined action of the claws and pads. The fir's pads are covered with thor-ands of minute short bairs, sticky at the end. There is no suction—marsly adhesion.

The action of a fir's pads may be illustrated by

"The action or a ny's page may be insertance by means of a piece objection; plaster and a few threads and small weights. Take a piece of sticking plaster half an inch wide and sew through it some short; pieces of thread at intervals of half an inch, and knot the threads on the ticky aids so that they mands put through. Stick the plaster to a dinner plate or other smooth object, and it will be found that if a small weight is attached to each thread the plaster will sen-tain in this way a considerable weights—this to to say,

disadvantages, for stickiness and locomotion are not always strictly compatible.

THE CONSEQUENCES OF STICKY FRET.

"All his grown-up life the fly has to manage with icky feet. Imagine our plight if the soles of our feet were sticking plaster, perennially renewing its stickiness! Whoever has experienced the sticky mud of certain regions will recall how the boots ball up and what a conglomeration one drags home from a ramble under such circumstances.

"To such inconveniences the fir is constantly ject, and it is this that has bred in him a hight frequently presning himself, particularly like for These size constantly becoming cloquel with spirit substances, and this contemporalism the My mean unbetween, and this contentration lies by a sidequisty restore if his feet are to set I was supporting him on stippery places. If this was tion to too stilley to rath of the fig flags it fell than passes will in the surrow. "Thus it is that all secrets" "Thus it is that all secret of subviscopic are moved from the fact of the flags. These particles are resulty if might be fill the with the middle are. Survey of might be for the state with the middle are. Survey of might be for the with the middle are.

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spired in ministrealy consisterable on account of the fire applicable. When Ries have access to diseased or rotten our found matter, the transfers thus effected are danger out. All corts of minute organisms are spread in this way, including diseases of mon, animals, and plants, it is impossible to go into details in this place, but it is only right to say that the imagination completely fails to greap the far-reaching consequences of this irransfer of greems and scores on the feet of fice."

A New Process of Briquetting Metal Shavings

DEDRYT developments in machine construction makes its construction made and construction one difficult to betain set the set sufficient arreages. The introduction of large suggines and the increasing use of superheaded steam here been the principal causes of this difficulty, but even the cylinders of small motors, with walls only \$4 er \$4\$ inch thick, are required to withstand, in testing, a pressure of 30 atmospheres. Martine engines, also, are continually developing more power and pressure, in proportion to their weight, and the task of the iron foundries is made more difficult by the commettion of case seed.

Hitherto estings requiring extraordinary strength have been made of Swedish iron and other special varieties, but a much less costly method of obtaining oast iron of the desired quality has lately been introduced. This result is obtained by adding to the tused motal shavings of fron, which have been formed into briqueties by great pressure, without employing any aggivings to binder.

It has long been known that the quality of cent tron can be improved by the addition of tron havings. In a process patented by George Whitney, which was in operation for several years, wooden or tron house filled with loose iron shavings were thrown into the furiance. The commercial success of this process was dependent on the existence of special conditions in the wood and iron markets, and the process was soon shauldened by the numerous foundries that had experimented with it.

mented with it.

The loose shavings were partly blown away by the
blast and partly converted into siag, owing to the
large surface exposed to oxidation. The total loss
produced by these causes amounted usually to at
least 10 per cont. Attempts were made to diminish
the free surface by allowing the shavings to rust together in the air, but the masses thus obtained were
no imperfectly congiouerated that they fell apart in
the furnace into loose shavings, which suffered the
fate described above.

The idea of compressing the shavings into briquettes with the aid of a binder then suggested itself, but the binder was volatilized in the furnace and

the briquettes disintegrated into loose shavings.

Now Mr. Rousy has discovered a method of converting from shavings, by intense pressure alone, into briquettes capable of withstanding great mechanical forces as well as the heat of the furnace. This process furnishes a market for iron shavings, which form a very annoying water product in machine shops.

By means of hydraulic presses, the shavings are subjected to a pressure which is moderate at first, but is gradually increased to about 2,000 atmospheres, or if tons per square inch. In this way the shavings are first interlocked and finally welded together into solid

brigattes without the use of a binder.

The addition of these brigates to ordinary cast from is much more beneficial than the addition of loose from sharings. The behavior of the brigatests is the reverse of that of all materials hitherto amployed, which appeared likely to diminish the proportion of carbon in the whole mass, because of their own amail percentage of carbon, but which proved of little value because they absorbed carbon is fusing. Although the cause they absorbed carbon is fusing. Although the castle of the properties of the carbon which they consist much loss through carbon the carbon which they contain, in the form of graphite, to be burned out above the sone of fusion. The carbon thus lost is not wholly regained in fusing, so that a considerable one glorescent carbon results. The beansfelal effect of the briquettes is due partly to an increased loss of silicon, which prevents the deposit graphite in coarse particles and large quantities.

beneafetal effect of the brigates in carbon results. The beneafetal effect of the brigates is due partly to this shedute decrease in carbon, and partly to an increased loss of silicen, which prevents the deposit of graphite in coarse particles and large quantities. The brigatests are useful for various purposes in addition to the casting of iron. By adding substances acclusiated to improve the quality or 'actilitate the working' of iron, beignestes of any desired composition can be made. A mandrial of more uniform composition than pig free ion; he obtained by mixing sharper of gray cast freed of different sorts. The Bortis figure made of united sharings of cast freed of different sorts. The Bortis figure and proposed in passing appears criticates.

tight uses brigateles hade of mixed shavings or tongae and recell in eaching applies orthoders. Se all metallurgisti operations in which comp steel a most brigateles of wheel and wrought from thating which form a charge and efficient substitute. Obline which press translated to not required out to be a second of the company of t

Borsis has made a series of experiments, with the following results: White iron was obtained by fusing briquettes of gray cast iron in a covered crucille, or in a coupola turnace. The loss of weight in fusion was found to be about 50 per cent for loses of the coupola turnace, and the coupola turnace are the coupola turnace of the coupola furnace cent for a furnitary set of the cent for piece cent for a furnitary of 50 parts of cast from briquettes, and 30 parts of pig from. Hence it may be assumed that the addition of the small proportion of briquettes required in foundry work would not appreciably increase the loss of type.

Experiments on the strength of the final products showed that the resistance to bending stress increases in proportion to the percentage of briquettes added, while the clastic limit remains nearly constant. The tensile strength and resistance to fracture by blows also appear to be increased by the addition of briquettes.

The Borsig and other large German foundries have already cast, from iron fused with an admixture of briquettes, bundreds of engine cylinders which show great strength and an internal surface of excellent grain.

Large from works sould profitably make their own briquettes, while small establishments could have their shavings briquetted in special factories, which would also purchase shavings from machine shops and keep a supply of briquettes for sale.

Dr. A Gradenwitz, who gives the foregoing account in Fromerfuses, adds that the Ronay process can be employed with advantage for briquetting shavings of other metals than Iron, especially such valuable metals as bronze and aluminium. Hitherto such shavings have been thrown into the smelting furnace in the loose state. In consequence of the great extent of surface exposed, 8 per cent of the bronze, 20 per cent of the brans and more than 50 per cent of the brans and more than 50 per cent of the aluminium are lost by oxidation and the metal retains particles of oxide which diminish its strength. If the havings are briquetted the loss is greatly diminished and the fused metal is perfectly homogeneous, so that it can be used directly for important castings, such as safety valves, high pressure pumps, sic briquetting slot gives a better control of the material

The briquetting process can be applied to ores, aswdust, coal dust and countiess other materials, and it appears destined to give value to many waste products. Sawdust, for example, can cheaply be converted into excellent fuel.

Briquettes of fron shavings have a loose texture which shows the separate shavings, while briquettes of easily fustble metals and some other substances can scarcely be distinguished from homogeneous solid blocks.

A Remarkable Vegetable Poison

RECENT experiments have demonstrated the existnee of a poisonous substance of very remarkable qualities in the seeds of so well known a plant as
the richna, or castor-oil plant, a common ornament
of our gardens.

It has long been observed that these seeds frequently proved fatal to animals who fed upon them, or to children who swallowed them by accident, but the toxic principle has first been isolated, as yet in very impure form, by Prof. Robert of Bostock, the process consisting of maceration in a solution of softium chlorids. Fren now the pure preparation cannot be obtained because of the small amount of the poison and the difficulty of separating it from associated abunisoids.

difficulty of separating it from associated abbuminoids. Even so its terrible potency is shown by the figures of Prof Ehrlich of Frankfort-on-Main, who estimates not be a sufficient to kill one and one-half million guine-pigs. This tremendous death-dealing power surpasses that of all other poisons known to us as enemies of living matter; such, for example, as strybnines and cyanide of potensium.

According to Dr. B. Rewald in Koemos, this quality alone would make the new polson of interest to scientists, but this interest is increased by the discovery of a very unique "polson stability" in this product. That is, if a quantity or polson be injected into an animal insufficient to kill but enough to cause severs tilness, the animal upon recovery is capable of enduring a second done sufficiently large to kill a fresh animal instantly Moreovery the done may be increased gradually a thousand-fold or ever ten thou-

shad-fold without causing unfavorable symptoms. This can, of course, be done to some extent with other polsons, such as arsenic and morphise, but in these the pessible dose always remains in very moderate proporties to the death dose, and corporeal disturbances are always manifested, while these are absent with the richus.

Another striking pseuliarity is that in the blood of these immunised antimals an antitoxin is formed. This likewise has not yet been isolated in pure form, but it has been possible to work with it as a fixed quantity. When this antitorin, found in the blood serum of an immunized animal, is injected into a freshly poisoned animal, it will provent the development of toxic symptoms, and will also cure one which has already become III. A similar action is of course well known in the case of bacterial infections, such as diphtheria, tetanus, etc.

Moreover, this vegetable poison shows another similarity to bacteris. We know that the blood serum of animals which have been previously treated with a bacterial poison possesses the property of agglutine-ting bacteria of its own sort floating in some medium, such as, for example, water—a property not possessed by normal blood serum.

Ricinus in solution possesses a like property, since within a short time it causes the red corpuscles to form a gelatinous clotted mass

But different kinds of blood vary in susceptibility to this action. For example, pigeon's blood and dog's blood show the reaction immediately, while it is absent or very slight in that of goats, lambs, and cattle.

Besides ricinus there are some rare seeds which contain bodies exhibiting similar properties

It is certainly very singular and noteworthy that on the one hand highly developed plants and on the other hand the lowest forms of life, should produce poisons which so strikingly resemble each other in their fatal qualities, in their creation of immunity, and in their power of agglutination.

Meat Scarcity and Meat Preservation

Even in uncivilized times and regions man has been thought by experience to provide against famine by preserving food in seasons of abundance. Although successful methods of preservation have been in use for centuries in all parts of the world, no really rational process could be developed before the cause of juttefaction had been discovered in hacteria, and means of preventing the growth of those injurious organisms had been found by experiment. The art of preserving food, including meat, which is especially prone to decay, has been so highly developed, chiefly by the labors of the bacteriologists, that food preservation has become an important factor in maintaining the balance between demand and supply.

The International Hygienic Exhibition, to be hold in Dreeden this year, will devote a large amount of space to this subject of paramount economic, as well as hygienic, interest, and will reserve a special section for exhibit illustrating the theory and practice of meat preservation. This information is given by the journal Hygien, the official organ of the exhibition, which summarizes, as follows, the various general methods of preserving meat.

These methods are four desiccation, cooling, beating and scaling, and treatment with chemical agents. Drying is a very old and good method, which is still practised by printitive races and, to some extent, in civilized countries. The method of drying meat which is used by the Laplanders, for example, will be illustrated at the exhibition. The special advantage of drying is that the meat loses none of its nutritive value, as it is neither leached nor chemically altered. The efficacy of the widely used process of saiting and pickling, especially dry-saiting, depends parity upon the fact that sait and sality-ter extract water from the meat and thus prevent the growth of bacteria, but these saits also destroy the bacteria by chemical action. In amothed meat, littlewise, the putreflying organisms are killed by the creosote and other ingredients of the smoke.

The preservation of meat by cold storage is now practiced on an immonse scale, with the aid of elaborated and the state of the state of

Of still greater practical importance is the method of preserving meat by heating or cooking it, and sealing it in air-light cans. Not only have the commercial canned meats and meat products become very popular, owing to their chapmess, convenience, and palastability, but the small and very efficient forms of sterilitizing apparatus, which are now made for household use, are beginning to appeal to many persons who are still suspicious of commercial canned meats, despite the skill, care, and governmental control which are applied to their production. Any householder can now preserve meat in perfect condition

As the use of canned most increases, the often recur ring rise in the price of meat will rapidly lose its terrors, and gradually become imperceptible. When strict control of food supplies shall have been established by sery government, and the restrictions which now hamper international commerce in meat shall have been sholthed, all local and temporary variations in production will be compensated by imports and exports.

Corresuondence

Solar Energy

To the Editor of the SCIENTIFIC AMERICAN: Just a few lines concerning the article in the Screntific American for January 21st on the "Utilization of Solar Radiation and Wind Power"

It was somewhat surprising that the leading American scientific journal should give space for an article and full-page illustration on such an impossible proposition as this

The inventor of this interesting device, Mr. R. A. Fessenden, proposed to cover an artificial lake with thick glass. He expects the sun's heat will convert the water in this lake into steam with which to drive an engine! Now any schoolboy knows that the rays of the sun can never raise water to the boiling point of 212 degrees without the use of condens ing mirrors or lenses

The solar steam engine is not practical, and never will be, owing to the expensive machinery of such a plant and the small and erratic nature of the power obtained therefrom. There have been described in the SCIENTIFIC AMERICAN several solar engines One of these, located in California, I think, uses a huge parabolic mirror to converge the sun's rays upon a small hotler placed in the center of the apparatus. A train of gears and clockwork is used to keep the whole affair constantly pointed at the sun as it travels from east to west across the heavens. A steam pipe carries the steam thus generated to a small engine, which gives 8 or 10 horse-power. This machine undoubtedly works, but the mechanism is complicated. quoteenly works, but the mechanism is complicated, delicate, and costly, and probably requires the constant care of an engineer. It is probably far from an economical power plant. Of course, it operates only when the sun shines.

Another device of similar nature, instead of using water in the boiler, uses ether or some other liquid with a lower boiling point than water. This obviates the use of mirrors, but the loss of the generating liquid must be considerable, even with the use of the best condensers, while the power obtained in this way is small in quantity and uncertain in nature

Mr. Fessenden's second scheme, which consists in using windmills to pump water into storage tanks, from which it is drawn to operate turbines and generators is more practical than the solar device. But why not drive electrical generators directly from the windmills, and store the power thus produced in ef-ficient storage batteries? This is already being done in several places, and for small plants seems to work It is certainly much less wasteful ergy than the water-storage-turbine system would be

By the way, what has become of the page for cor-espondence formerly contained in your esteemed paper? This was a very interesting feature, and I trust is not going to be discontinued Your paper is paper? This was a very interesting feature, and I trust is not going to be discontinued. Your paper is certainly greatly improved since the new year, and your efforts are sure to be appreciated by your army of readers.

East Canaan, Conn.

Longer Piers at New York

To the Editor of the SCENIFIC AMERICAN: in your article of February 4th, on the "Longer Piers" controversy at New York, and the editorial on the same subject, you cover the ground exceedingly well but for a few points which should not be neglected,

and which require no argument The origin of the controversy was as follows:

One of the great foreign companies, operating to this port, came to the government at the eleventh hour saying that they were just completing a great new ship and wished to encroach 100 feet on the fairway for her accommodation. The present pier head line was established by competent government engineers for the best interests, not only of the port, but of the river and of the whole country, and its establishment was to safeguard the future

Twice before this, corporate and local interests have sought to encroach beyond this line and twice they have failed and made other satisfactory arrange-ments. Such arrangements can be made perfectly well now, and the petitioning companies and the Department of Docks and the government engineers all know it. Below West 41st Street and above West 44th Street are considerable stretches available for piers. The stone builtheads are not yet built in these places and the general character of what piers are there is and the general consistence of what pure age there is more or less temporary. By keeping the bulkhead about where the old bulkhead was and now is, and by skewing the piers a little, they could easily be made

newing the piers a ricke, took daily make 1,000 feet long.

The talk of these larger new ships going to any other port than New York is hardly worth a busy man's thought. New York is the only place that can give commerce of the quantity and class required. If

New York should get 100 feet extended into the fairway the Jersey Commission would demand the same thing. Larger ships are surely coming if past records show anything, and larger ships certainly need a commodious harber. Again, besides the larger ships the aggregate commerce will be immensely larger in twenty years, and it would seem criminal to congest the harby-active state. the harbor or take away any of the lee-room which

Comparison of Liverpool or other harbors is mea ingless without comparing also the character of the harbor traffic, and in no other harbor of the world can such an intricate, criss-cross, complicated traffic

be found as in New York.

We have the best harbor in the world, and it is the business of the engineers of the government to main-tain it. They are responsible to no parties or corporations or private interests, and the measure of their sibility rests only in their own judgment of the future welfare of the port, the river and the country. By holding up their hands we will be doing an act for which the future will bless us.

New York, N. Y.

BOATMAN.

A Mechanical Problem of Puzzling Interest.

To the Editor of the SCIENTIFIC AMERICAN:
Will you kindly submit to the readers of the SCIENTIFIC AMERICAN the following mechanical problem,
which I believe to be of some puzzling interest, even if it looks so simple? I have not seen two p that give the same quotation or figure it out in the

I, II, III are three distinct problems, and may represent three independent sets of rollers or three sets of planetary gear movements. A. A', A" are internal gears. The figures (111, 25, 61) (111, 27, 37) and (111, gears. The figures (111, 25, 61) (111, 37, 37) and (111, 45, 21) are the number of teeth upon the different

The questions are If internal gears A, A', A'' are held stationary, many revolutions are required of gears (C, 61),

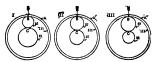


Diagram of mechanical problem.

(C, 27), and (C, 21) to carry satellite gears (B, 25), (B, 37), and (B, 45) one revolution around internal genrs A, A', A'', or back to the starting point marked

II. If vice versa, gears (C, 61), (C, 37), and (C, 21) If esco versa, gears (0, -6), (0, 37), and (0, 21) are held stationary, how many revolutions are required of internal gears A, A', A" to carry satellite gears (B, 25), (B 37), and (B, 45) one revolution around stationary gears (0, 61), (C, 37), and (0, 21)? III. Which is the simplest solution or key to the

Chicago. III. JOSEPH DE MARTINO

Spread of the Rural Telephone Movement

THE movement for communication among farms and for better connections between rural and city districts has increased wonderfully within the past few years. To those who are ignorant of the real statistics, the figures of the latest telephone census are amazing.

are amzung.

For the period from 1902 to 1907 the number of rural telephone stations in the entire country increased 449 per cent In 1902 there were but 286,866 rural telephone stations in the United States; five years later there were 1,464,773.

The census figures show that the South has a great share in this development. The increase in the South Atlantic States was 469 per cent, and in the South Central States it was 367 per cent. The actual figures, however, mean more than percentage, showing steadily wherever the telephone has gone it has brought

with it better living, an increase in the productive ness of the farms, and money-making opportunities for the agriculturist that were not dreamed of befor the agriculturist that were not dreamed of be-fore. But when one considers that in this five-year period the number of rural telephones jumped from 94 to 5,073 in Maryland; from 270 to 12,652 in 105 to homs, and from 189 to 12,403 in Arkanasa, the mass-ner in which telephones were popularised and raised from the statistic of a rich main buxury to that of an every-day necessity of all the people can be residily

The census, though its results have only recently been published, does not bring the actual conditions quite up to date. No figures are available for the

July & Caller 19

year and a half since December First 1807, but the increase in the number of zoral telephone stations has been even more marked them in the five-year period to which the statistics return

pariod to which the statistics refers.

The reasons for this growth are not hard to find.

Life on the farms used to be irksome—distances were
og great. The telephone is the annihilator of distance. As one farmer expressed it, "I am next door
to everybody I want to talk to. That telephone puts
my isolated farm in the heart of things." Rooswell's Country Life Commission designates the telphone as one of the forement influences making for
the architect of the wivel mobile. the solution of the rural problem.

en it is considered that the average farmer can when it is considered that the average tarmer can install this advance agent of development at a cost less than the present return from a bale of cotton, or thirty bushels of wheat, it is not difficult to understand why the rural telephone is making great strides throughout the entire country.

The part which the farmers themselves have taken

in the telephone movement makes it one of considerable importance. It is a fact that for very small trouble and expense a group of neighboring farmers can buy, build, and maintain a serviceable telephone system. The work of installation is not so very different from ordinary fence-building operations about the farm. Equipment conforming with the best recognised standards is at the disposal of progressive rural citizens for their telephone building.

It is not an unusual sight to witness gangs of farmers at work on the roads, erecting poles, string-ing wires, and installing the instruments in the farmises along the countryside. This work is u on a co-operative basis.

Often some sort of an organization is formed. Some-times six or eight neighboring farmers start the movetimes are or signt neignoring farmers start the move-ment. In case there are as few as this, no switch-board is necessary. Construction and maintenance are of the simplest nature. A single pair of wirss will suffice, and the "party line" system is found the most convenient and useful. As demands grow and the little rural companies branch out, extensions are made, and, usually, connection through trunk lines with the rest of the world.

It is interesting to note that the adoption and de-velopment of the telephone in a rural locality is attended by a minimum of expense. Of all the agencie that help bring greater opportunities to the farmsthe goods road movement, railroad extensions, the rural mail delivery, and the farm telephone—the least costly, and, because it reaches the largest number, the most important, is the telephone.

No longer does the farmer consider "the voice in the

box" as one of the mysterious things for the city fellow to fool with, and for the farmer to let alone. The ease and small cost with which the neighborhood telephone line can be constructed appeals to and

Manufacturers of telephones, and operating tele-phone companies generally, publish books and pamph-lets describing "How to Build Rural Telephone Lines." see publications treat the subject in a simple and comprehensive way; they are profusely illustrated in a way which enables any one with ordinary intelli-gence to construct a practical telephone line of a limited number of stations.

Increasing Use of Automobiles by the Farmers

A CCORDING to the Bureau of Statistics at Washington, a careful compilation of all available returns has shown that last year the farmers of this country purchased 25,000 automobiles—an in-crease of 85 per cent over the previous year and more than 400 per cent over the number of cars purchased by them in 1909. The farmers of the South and by them in 1909. The farmers of the South and West especially have come to realize that the modwest especially have come to realize that the mod-ern auto cars save both time and money for them, besides being put to use in various ways upon the farm. It is no longer a hxuny, but a necessity, and consequently all who can possibly afford it are inconsequently all who

An Agricultural Motor Competition

an agreenternal Hoder Competition
Tythern will be an agricultural motor competition
Tythern will be an agricultural motor competition
at the Camelian Industrial Exhibition, which is
to be held in Winshipe, Canada, from July 5th to
July 25nd, 311, and which will be open to the world.
The sugineers in charge will be Peof. A. R. druig and
L. 7. Smith.

Paris Exposition

Figure 1 seems the properties of Perish in some talk of hering an exposition of Perish in 1820. The senatorial commerce and in clustry committee justry rout in faith of the product. It is intended to bring the matter before the Historic Commerce and to have Parliament tiple some action thereignen. However, it is not at all certain tiple the product will be carried through, an those in product will be carried through, as there is a suffernishing to it.

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Dynamite on the Farm

Explosives as a Substitute for Ax, Plow, and Spade

By Willard Young

DYNAMITE has been employed for some years in clearing new land of stumps, boulders, rocks and standing trees. The redwood, for and pine stumps of the Pacific Coast are biasted with low grade, slow acting dynamites. The amount required depends on the uise of the stump, the kind of soil in which it stands and the nature of the roots, and generally ranges from ten pounds to five hundred pounds. Sixty per cent quick acting dynamite is necessary for cypress stumps in swamps, while thirty per cent to forty per cent slow acting dynamite usually does best with oak, pine, elm, ery, chestnut and the general run of stumps.

st all vegetation is, of course, directly enced by the depth, moisture condition and ingredients of the fertile surface soil. Under the surface soil at a greater or less depth and in varying thickness is found the subsoil, which often cannot be penetrated by moisthe sussoit, which of the calm to be peterted by mois-ture or plant roots, and which at best yields but little plant food in its compact state. When the subsoil is quite impervious and underlies low ground, swamps or ponds exist above it. If such subsoil occurs under perfectly flat and level ground, the surface is generally marshy. Under rolling land, compact subsoil is not a serious restriction to plant growth, provided the alluvial surface soil be deep. If it be thin or shallow, the land will not retain sufficient moisture to sunply the plants through dry weather. Again, thin sur

sired length can be excavated instantly without any shoveling. Ditches fitteen feet wide are excavated by exploding the dynamite in three parallel rows of



Felling a tree with dynamite.

Subsoil under land is broken up with quarter-pound to half-pound charges of 25 pc; cent to 30 per cent slow acting dynamite exploded in holes sunk from two to feet at regular intervals. The depth and space ing of the holes and the size of the charge depend on the thickness and condition of the subsoil Experiments in subsoil four feet thick under a foot of surface soil have been made by sinking pits midway between holes spaced at various distances. These experiments have shown that a half pound 25 per cent slow acting dynamite exploded in the holes driven down to six inches above the bottom of the clay sub soil will properly break and crack the subsoil to a distance of eight or ten feet. The proper spacing for the holes in this ground is therefore fifteen to twenty feet Holes fifteen feet apart average about one hundred and ninety-four to the acre, and holes twenty feet apart average about one hundred and eight to the acre The cost of labor and explosives to blast an acre of this kind of subsoil is from fifteen to twenty dollars. In some places land on which nothing of value could be grown has been transformed into excellent farms by subsoil blasting, and in many other places it has increased crop yields from twenty to fifty per cent

Dynamite is also used extensively to break up the subsoil in orchards. Here holes are put down four



Boring the holes for a dynamite



A series of tweive 3-inch holes, placed 20 feet apart and filled with dynamite, produced this effect after explosion.

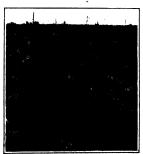


Blasting out a

face sail is quickly eroded from hilly land. In some places where the surface soil on rolling land is thin, efforts have been made to retain it by throwing up ridges or dikes to check the wash of heavy rains.

The only satisfactory method yet devised of upheav-ing and disrupting subsoil is to blast it with dyna-mite. Swamps are drained by drilling several holes in the deepest part down through the impervious sub soil and exploding in the bottom of these holes from three to fifteen pounds of 30 per cent or 40 per cent dynamite having good water-resisting properties, semigelatin or gelatin dynamite being be st for this work When properly done this blasting shatters the subsoil so that it affords permanent drainage and so that the swamps do not form again.

Marsh land is recovered by ditching. The ditches Marsh land is recovered by ditching. The ditches and drains are catewated by exploding charges of approximately a half pound of 50 to 60 per cent quick setting drampite in holes put down in a line and spaced approximately two feet apart. Only the middle charge in the row is primade, and the explosion of this charge causes the entire row to explode. In this way a skitch three feet deep, five wide and of any de-



Land ready to be cleared of stumps.

or five fect deep midway between the trees, and the explosion of a half pound of 25 per cent or 30 per cent slow acting dynamite in these holes opens the subsoil so that there can be no root binding. The explosion also destroys grubs and bootles and tends to prevent wet rot and other fungus growth. In some places, where overlards are failing, it is the custom to explode a charge of five or ten pounds of powder about ten feet deep directly under the tree

When young trees are planted the hole is dug with a quarter pound or half pound of 30 per cent dynamite This loosens the surrounding soil so that the tree roots can spread extensively and also grow deep into the can sproud extensively and also grow deep into Lis subsoil for moisture. In some ground trees planted in blasted holes are almost twice as large when a year old, as those planted in holes dug by hand Dynamite is also used on the farm to excavate

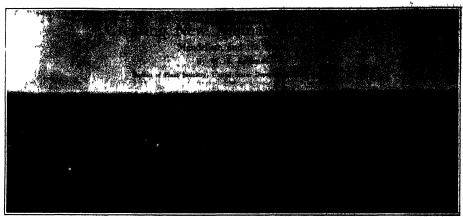
trenches for tiling or for pipe lines, to dig cellars and foundation trenches, to grade and ditch roads, to sink wells, to clear ice from watering places for stock and to break ice gorges in streams, to dig holes for poles or for fence posts and to split logs for fence



This is not a row of seps, but a blast of dynamits. The object of the blast is to make a ditch. and the second second



Punching holes for ditch blasting, which is just as easy as it looks and a



N the practical affairs of life practice usually pre cedes science frequently by many years the scientist discovers the principles which underlied practice and thus enables us to improve on former ractice Much improvement in domesticated ani mais and considerable improvement in farm crops was made before we discovered any of the fundamental principles involved. Important discoveries in this line began about twelve years ago It is true the most important of all these discoveries was published in 1865 but it was in advance of its time and was forgotten until rediscovered by several men about 1899 to 1901 The art of breeding both of farm crops and of farm animals may now be said to be an applied The principles which have been dis overed will be stated here in the briefest possible form

SELECTION

The old method of improving crops and animals was by selecting the best individuals for breeding pur poses It was thought that this produced actual im provement in the individuals selected however that it does not do this but it does elimin ate inferior strains and thus raises the general level of excellence of the breed Much improvement has made in varieties of wheat potatoes corn and in all of our improved breeds of farm animals by se lection without any attempt at cross breeding of dif ferent varieties B it it m ist be remembered that the improvements thus made can at omplish only segregation of the best individuals or combinations of characters existing in the loquilatin with which we began the selection it cannot produce any im ment beyond that point

It frequently occurs that two different varieties or breeds each possessing excellences and defects can be crossed and a new variety or breed made combin ing the ex ellen es and eliminating the defe ts of the breeds or varieties used in the cross It is only dur ing the past dozen years that this has been known and the reason for it understood. It is true that Gregor Mendel discovered this principle and published it in 1865 so that it is now known as Mendels law but no practical use was made of it until it was re-discovered a third of a contury later

There are three important principles involved in The first is the principle of domin Mendels law ance Figs 8 and 6 illustrate this principle In Fig. 8 a bearded wheat with lax heads shown at the right as crossed with a beardless Club wheat shown at the left. The hybrid which is shown between its parents has a Club head and no beards Characters which show in a hybrid while their opposites do not show are said to be dominant and the characters which do not show in a hybrid although present are said to be recessive In Fig 6 a polled or horn less animal is shown One of its parents had horns, the other did not It is seen that the poll character the other did not. It is seen that the poli character is dominant and the horn character recessive. This principle is of great importance especially in producing new varieties of potatoes fruits, etc. which are propagated by cuttings A hybrid when it reproduces from seed does not reproduce true to type but when reproduced from cuttings it reproduces per-fectly true to the type of the hybrid

SECOND GENERATION OF BROWN X BLUE EYES

- Br Brown Bl Blue
- Br=Brown Bl=Blue

 1 Br fr F and Br fr M = BrBr

 2 Br fr F and Bl fr M = BrBl

 3 Bl fr F and Br fr M = BrBl

 4 Bl fr F and Bl fr M = BlBl

The second principle is that known as the law of segregation Referring to the animal shown in Fig 6 which is a hybrid between a horned and a polled breed according to the law of segregation this animal will transmit the horn character to half its offspring and the poll character to the other half

The third and most important principle which Men del discovered is known as the law of recombina-tion. It is a result of the law of segregation and the further fact that each pair of characters segregates

without any reference to any other pair According to the law of recombination the second generation of a hybrid if sufficiently numerous, will present every possible combination of the characters of the parents The foregoing table shows this law se of eye color in human beings Both parents in this family: (1) Those inheriting brown eyes brown eyes and blue eyes Brown eyes being domin ant over blue eyes these parents are both bro There are four classes of children which may appear in this family (1) those inheriting brown eyes from both parents these will be pure brown-eyed. (2) those inheriting brown eyes from the father blue eyes from the mother (8) those inheriting blue eyes from the father and brown eyes from the mother these two classes will be alike and like the parents (4) those inheriting blue eyes from both parents and they will be the only blue-syed children in the family. Thus in such a family, on the average of a large number of cases, one fourth of the children will be blue-eyed.

APPLICATION OF MENDELS LAW

Many important applications of the principles above enunciated have been made in producing new varie-ties of farm crops and new breeds of animals Many

ties or tarm crops and new oreasts or animals samp other applications can be made \[\lambda \text{vow Varieties} of Wheat—Eastern \] Washington eastern Oregon and northern Idaho is one of the great wheat-growing regions of the world \[\text{The farm} \] ers in that section in the early day tried every variety of wheat known in order to find varieties adapted to their conditions In the vicinity of Pullman where the State Experiment Station is located up to where the Blate Experiment Station is located up to 1899 the farmers had found only one variety that was satisfactory and it had some serious faults. The difficulty with practically all the varieties tried ex cept this one, was that the straw was weak, and when a rain storm came after the wheat had grown up in the spring it would blow down Again except this one variety when the grain got ripe the chaff would

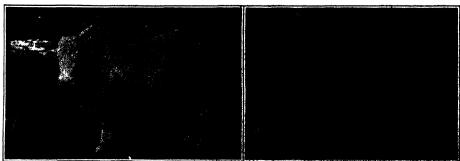


Fig 1 —Brahmin bull owned by Georgia experiment station and used in production immunity to Texas fever in southern cattle.

specially. If the weather was windy. But the Library and the Library and the secondary if the weather was windy. But the Library and the libra that time Agriculturist to the State Experiment Sta-

Palescon 18, 1911

tion of Washington, and attempted to find a winter wheat of this character. Hundreds of varieties were obtained from all over the world, but none of them would stand up and hold its grain. At that time Mendel's law was not known, but in the hope of producing a complination of the good characters of some of the best winter wheats and the Little Club spring wheat numerous crosses were made. Fig. 3 shows Prof. E. E. Elliott, who was at that time the writer's assistant and who later succeeded him at the Washington Sation, making the crosses in the field. He is here transferring the pollen from one variety of wheat to the stigmas of another variety. The first generation hybrids were harvested in the summer of

1900 The seed of each hybrid plant was kept separate and sown by itself in the fall of 1900. While these wheats were heading out the next year, the writer discovered the law of recombination. He found that in every row every possible recombination of the only parent characters was present

For instance, Fig 10 shows the Valley and Little Club varieties six first generation hybrids of these two varieties, and the types which each of these six hybrids produced in the second generation At the top of the figure the small head at the left is the Lift-tle Club variety, the next is the Valley. The left half of the picture shows the results when pollen (Continued on page 284)

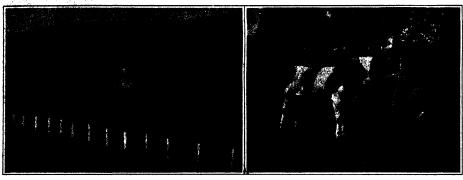
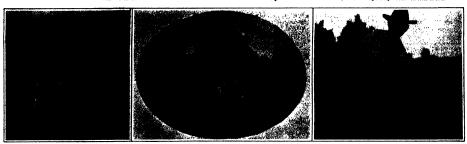


Fig. 3.—Hybridising wheat. Transferring pollen of one variety to the stigmas of another.

Fig. 4.- A Holstein bull. Note the characteristic white stripe over the hips and just behind the shoulders, which frequently occurs in this breed.



type produced by the application of Mendel's law of recombination.

Fig. 5.--A pure polled animal of the Hereford Fig. 6.--A cross-bred animal having a horned dam and a polled or horniess sire, illustrating domin poli character.

Fig. 7.—A Hampshire pig, showing the white belt which is characteristic of this breed. Breed been able to fix this belt,



Fig. To Hybrid butween Velley and Little Club. The Valley type is shown at the right; the Little Club at the left, the hybrid in the addition



Fig. 9.—Regget weel, worth three or feur times the price of erdinary wool.

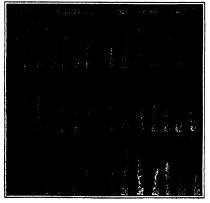
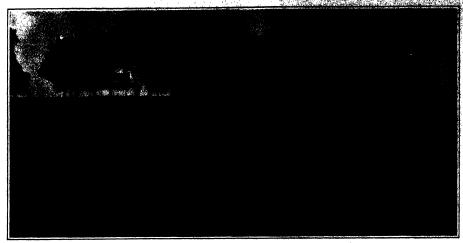


Fig. 10.-Parents and first and second generation hybrids of wheat produced at the Washington State experiment station. In this cross valuable new varieties of wheat were produced.



PARM owners and operators are appreciating the economic value of concrete more and more every year. It is not only the large farmer who can use concrete to advantage, but the small farmer can do so as well.

The use of concrete on the farm is practically unlimited, therefore we can only mention a few of the many uses to which it can be put. These, however, may seem many to the uninitiated, or to those who have given but little thought to the subject.

Among the most popular uses are the making of feare posts, walke, hars floors, watering tanks, lawn rollers, derains, foundation posts and floors for corn richs, windmill foundations, root cellars, restaining stapping blocks, hot-house hor-kers, restaining stapping blocks, hot-houses, to-hot-house benches, heart nests, noutry houses, smoke houses, granaries, hitching posts, porth columns and foundations, garages, herras, hog trougts, piggeries, dairy houses, and ice

What makes concrete to-day more popular than ever is that it is an excellent substitute for lumber, the cost of which within the past few years has reached almost prohibitive figures. Therefore it is only natural that a material which has a many advantages over lumber should appeal to the farm owner as strongly as it does

Aside from its moderate cost, concrete is more durable and sanitary than wood, its maintenance cost is practically nothing, and it is absolutely fire-proof. Thus the fire risk, excepting the contents, is entirely eliminated where it is used. Another point in favor of concrete may be found in its ornamental possi-

bilities. Being of a plastic nature, it can be molecular into plain or ornate designs as fancy dictates, and if the owners artistic taste runs to color, he may insert, here and there, a colored tile. This will break the monotony of even the plainest design, and will also add individuality to the work. When making hitching posts, horse blocks, retaining walls, gate posts, etc., effective surfaces may be obtained by placing varied-colored field stones near the idios of the mold. Then when the mold is removed these will show plainly on the face of the work. Surprisingly beautiful and attractive results can be obtained in this way with but

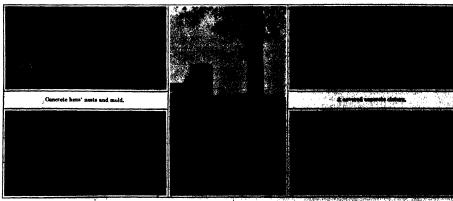
little strill and insensity.

The cent of concrete is trifling, for in most instances and and stone suitable for the work can be found on one's own farm, or if not, some seartly farm will have a good deposit of sand or gravel which one can get for the basiling. Therefore the only cash outlay required is that for the cement, and this is sold for a remarkably low figure. Just to give the reader some ties, of how easy it is to make useful things in con-

crete, a few general instructions are given below. For instance, we will take a watering trough. Every farmer knows the necessity of a good watering trough for his stock. It is probably one of the most useful and essential devices about a farm, and when made of concrete it not only presents a pleasing appearance, but is also practically indestructible. Watering troughs can be made with or without reductoring. If reinforcing is used, the walls of the trough can be made thinner. The forms are simple to make. As a rule, it is best to make the trough where it is to be perpanently located; for if in et, on account of fix

weight, one will have trouble in moving it around. The first thing to do is to build a bettomises wooden box, the inside dimensions of which must correspond to the outside dimensions of which must correspond to the outside dimensions of the finished trough Locate this on the ground where the trough is desired, and tamp the earth, which now forms the bottom of the box, down good and hard. On the ground thus tamped deposit concrete for a depth of about six inches; this will form the bottom of the box or trough. After tamping the concrete, and while it is still soft and wet, set the inner form on it. This still soft and wet, set the inner form on it. This finished trough. Oll or gresses the outside of which are the same as the desired inside dimensions of the finished trough. Oll or gresses the outside of this mold well, and be careful to set it central, so that all four sides of the trough will be uniform in hickness. Then fill molds, and level off fush with the forms remain in place for two or three days before removing so as to give the concrete a chance to become hard. The principal precautions to take in building a concrete water tank are to see that a rich not: turn is used, that it is pound in a mederately thin consistency, and that the forms are completely filled in one operations.

A good beery roller in always useful about a farm. For a trifling sost an excellent concrete roller can be made. A piece of sheet from can be used for the outer form. It abould be formed into a circle, and half in shape by wrapping thermly with light-weight wire. In the outer of this circular form is piaced a gas pipe, through which the shaft can be inserted when the roller is complete. After the form has been set up and the gas pipe properly centered, it



Circular trough and wooden sweep with which mold was formed.

A gate post built of concrete.

Make the party later of the special countries of the

which with a good was neiture of concrete free dissert which a good was neiture of concrete free dissert with owns away saally from the cost can't taken it not come away saally from the cost can't taken it not concrete spiritude. It would be wall to leader the mode or choice the place for three or four dary stips the concrete has been poused and then remains them, had wat down the east every day for at tense a week or more, ha order to harden it thoroughth.

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a connew path is the feundation This should be

made of joins process material, such as cluders. It

should be sti least att inches deep and should be

tamped deem well and leveled off theirly smooth On

concretch, made up of one part Forciand content to

two parts of sand and from four to five parts of

grayel or brokes stone. Tamp this mixture until the

two parts of sand and from four to five parts of

grayel or brokes stone. Tamp this mixture until the

to dry or set a one inchchick top wearing surface

should be laid on it. This top layer should be made

of one part of cement with one and a half to two parts

of good clean sead It should be allowed to dry until

ti is fairly stiff and then it should be smoothed off

with a weedem foat. Froetch the surface from the

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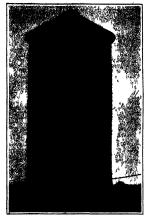
prevent cracking.

From the above it will be seen that there is noth ing very difficult or complicated about working in cement. The use of concrete fance posts is something that is becoming very general. This is due not only to the scarcity and high price of good straight-grained wood posts but to the almost un limited life of the concrete posts their great strength and their nest and pleasing appearance. It is claimed that excellent concrete fence posts, about seven feet in length can be made on the farm for from twenty to thirty cents apiece. This does not include labor cost but represents only the cost of material for the concrete and the wire reinforcing for each post

The Department of Agriculture at Washington, D C has just issued a bulletin on How to Destroy the Rat "Rats derour grain carry infectious diseases from house to house and have become such a pest that the Department has made exhaustive investigations look

14 W

ing to their destruction Obviously the most direct procedure is to rob them of their nesting place and with this object in view concrete floors are recom mended for barns positry houses corn cribs, and granaries The experience of many farmers is that



Filling a monolithic concrete sile.

grain mature enough to be placed in storage will not spoil on concrete floors nor will corn mold in con tact with them if there is good ventilation and the roof is tight

Another use for concrete is the building of subose or large tanks in which folder is placed and preserved in a green state for feeding stock when a natural green pasture is not available. Slios to-day are reconsidered a necessity by the modern farmer. For it is
a tainmed that a crop preserved by the use of a silo is
increased about forty per ant in value over that of a
a crop harvested in the usual way. Concrete indee
taself to the construction of slios better than any other
material. It is one of the better non-conductors of heat

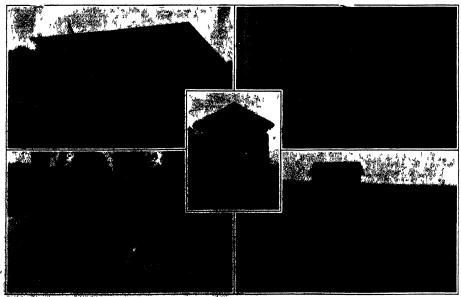
and cold. On this account the temperature of the in side of the silo will be fairly uniform regardless of the prevailing outside temp rature. Concrete silos are dreproof and are not abubt to rot or rust under the action of the scids formed by the slight forments tion in the silage or by the alternate wetting and drying out which every silo receivs. They are also wormin and rat proof. Concrete silos are, senurally made circular in form and from two to three times, that did not be silved to the silon three times, that it has a silved of concrete blocks but more often are nad with monolithic or solid walls. A reinforced one ete silo can be built cheaper than one that is 1 tr inf reed for the reason that tilmus walls can be 3 1 and thus the saving in concrete more than offsets the out of the reinforcing steel required.

Being a poor conductor of heat and cold as mon tioned above concrete has been used most success fully for the construction of greenhouses and ice houses. A greenhouse built of concrete not only either inside contains a possible as required in a wooden structure but it also saves fuel as it retains heat and keeps out cold. The fundations and side walls can be made of soild concrete as can also the posts and ridge poies the latter however should be reinforced with steel. The tables and benches in the greenhouse should also be made of concrete for by so doing the large expense and inconvenience of removing every few years the old decayed wooden benches will be saved. There are various designs of greenhouse benches Some cast all in one piece and others are made up in sections of concrete slabs Whichever form is used it will be well in order to facilitate the drainage of the water from the table to provide drainings holes in the bottom of the benches

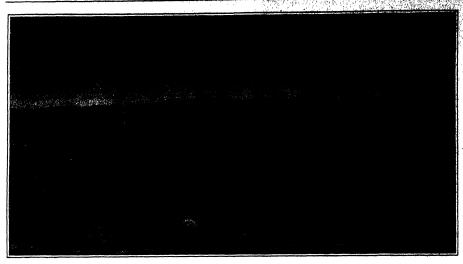
Concrete ice houses owing to th ir durability strength and insulating qualities have giv i considerable satisfaction. Fig. erice is has slown that the houses which give the greatest efficiency are those which are built with a double wall. Trees walls are generally about twelve inches this hand are made up of two three inche walls placed six inches apart tied together with galvanized iron rode or straps thus making a six inch wide continuous dead air space between the two walls which adds greatly to the in sulating efficiency of the buildings. The roof is also made hollow, to further the insulating qualities of the struture.

Root cellars and mushroom cellars are now commonly made of concrete The root cellars are usually built half below and half above the level of the ground

The side walls the partitions for the bins, (Continued on page 28)



1. Company of the American State of the Contract of Co



Soll, fertility is our most important natural resource, for upon it depends the feeding of the nations of the earth and the perpetuation of the human race. It is for this reason that, as stated by differd Pinchot and forcefully maintained by Dr. Hopkins, of the lillinois Experiment Station, 'the waste of the soil is among the most dangerous of all wastes now in progress in the United States.' American farmers have been especially improvident of this resource in the past, and have impoverished their lands to such an extent that production has not kept pace with consumption, and an era of high prices for food has resulted.

The waste of the soil results not only from reproducts without adequate return in form of manure and fertilizers (see the article "How the Scientific Farmer Fertilizers (see the article "How the Scientific Washing and lesching of the soil, but sino, as so clearly shown by the work of the United States Bureau of Soils, from faulty adaptation of crops to soils.

Unsuccessful attempts are made to grow crops on soils not autied to them, or productiveness declines as a result of improper methods of culture, and the soils are said to be "szhausted," "tred," "sick," or "out of condition." These terms have long been used, but we are just beginning, in the light of scientific investigation, to understand what they mean.

Never before has there been such activity as at the present time in studying the properties, resources, and capabilities of soils and in disseminating knowledge of correct methods of soil culture. Never before have the resources of science been so drawn upon to add the farmer in respling a profit from the soil. As Secretary Wilson points out, the results are becoming evident in greater returns per acre from the soil. As the first step in laping a foundation for the

As the first step in laying a foundation for the selection and utilization of soils, scientific men in all parts of the world are busily engaged in surveyins, mapping, and studying the crop adaptations of soils. The United States Bureau of Soils has carried on

The United States Bureau of Solis has carried on such work to a number of years, and up to June 30th, 1916. had surveyed, mapped, and studied the agricultural capabilities of 359,648 quare mileo or 203,120,969 acres of the United States. Typical areas and solis in all parts of the United States have thus been studied and reported upon. These reports are of especial value to the prospective purchaser of land and as an aid in the choice of crops to be grown or of solis suired to special crops. As a result of such work, the United States Department of Agriculture and the State Capterinent stations are prepared to give specific advice regarding the character and capabilities of solis in simpst every region of the United States.

Such surveys show the present condition and cappilith surveys show the present condition and caphas gone much further than this. If has dealt with the fundamental principles of soil fertility, the cause's of deterioration of soils, and methods of restoring their gertility, and in this work the highest skill of the chemist, hip physicist, and the beateriologist has been enliated, for it is now understood as never before that the soil is not an inert medium for the support of plants, but a complex organism, in which the most varied chemical, physical, and bacteriological forces come into active operation. In order to be productive soils must not only contain the necessary food for plants, but must have suitable conditions of texture, mosture, and temperature, and furnish a favorable medium for the growth of beneficial microorganisms (bacteria).

in the scientific study of the soil, certain welldefined groups of methods of investigation have been
pulpoid. These include (1) chemical and mechanical or physical analysts; (2) pot experiments, in
which plants are grown on small amounts of soil
under comparatively well-controlled conditions of
moisture, temperature, etc., and the behavior of the
plant noted as an index of the character of the soil;
and (8) field or plot experiments, in which crops are
grown on the soil under natural field conditions. Each
of these methods has its advantages and limitations.
Chemical analysis shows the proportion of plant food
present in the soil and to a certain extent the availability of the different constituents. It shows whether

Fig. 1.—Method of determining the amount of water

a given constituent is deficient or present in excess and whether harmful substances are present. Chemical analysis is therefore indispensable in any thorough study of the present condition and probable durability of a soil, but is not alone sufficient to show productiveness or fertilizer needs.

Chemical analysis has shown that the soil must contain sufficient amounts of about fourteen elements in order to support normal plant growth, and that while most of these are usually present in abundance while most of these are usually present in abundance, some, more particularly nitrogen, phosphoric sold, and potash, and sometimes lime, are especially likely to become deficient in the course of ordinary farming, and must be restored by the use of fertilizers. From analyses of a large number of soils from different parts of the United States, Hilgard shows that soils from regions of normal rainfall contain on the average 0 12 per cent of nitrogen, 0.11 per cent of phosphoric acid, 0.22 per cent of potash, and 0.11 per cent of lime, while those from regions of scanty rainfail contain 0.10 per cent of nitrogen, 0.12 per cent of phosphoric acid, 0.78 per cent of potash, and 1.36 per cent of lime. Calculated to pounds per acre, and assuming that a cubic foot of average soil weighs 80 pounds and an acre to a depth of one foot weights 3,484,800 pounds, an acre-foot of soil contains the following amounts of the principal elements of plant food: In humid regions, nitrogen, 4,251 pounds; phosphoric acid, 3,938 pounds; potash, 7,327 pounds; lime, 3,764 pounds. In arid regions, nitrogen, 3,520 pounds; phosphoric acid, 4,077 pounds; potash, 35,404 pounds, and lime, 47,463 pounds. The arid soils are thus shown to be much richer in all of the conare thus snown to be much richer in all or the con-stituents except nitrogen, than the humid soils, and this explains the well-known fertility of the soils of arid regions. Soils are, however, so variable in chemiand composition that it is difficult, and in many cases impossible, to classify them as regards fertility on this basis. Nevertheless, it is desirable to have an approximate standard for interpretting the results of obsented analysis of a soil. Hilgard the results of chemical analysis of a soil. Hillgard stakes (#th potent may vary from 0.8 to 5.6 per cent in heavy clay belone may vary from 0.8 to 5.8 per cent in heavy clay belones, from 0.48 to 0.3 per cent in leighter learns, and may fall below 0.3 per cent in sandy loams and below 0.1 per cent in sandy loams of great depth, with good productiveness and dissability. One-fourt, or one per cent (0.35) is considered generaty adequate. Line veries from 0.1 per cent in high sattly soils to 0.35 per cent in clay loam, by 0.9 per cent in heavy clay cells, and thay rise to the 0.9 per cent the per cent of the per cent in the contract in the cent of the cent in the cent of t phosphorte cold, when accompanied by a fair supply of limb, is usually sufficient for productiveness. One-ionth per cent of nitrogen is also completed adequate

as a tule.

Solis its composed essentially of mineral matter and organic matter, the organic matter is commonly related to the chains. Human segments organic materates whethere is no tention of the second of the chains in a second or the chains in a rate both. In second one of the chains in a rate both, in second one of the chains in a rate both. The per work by the chains of the consistency of the chains of the proportion of this consistency of the chains of the proportion of the consistency of the chains of the chain of t

a it depends to a large extent the pitro y of the soil, the availability of the mineral constituents (phosphoric acid and potash), the food supply of benedicial soil bacteria, and the physical condition of the soil. Suyder found that Minuscota soils, which had been subjected to continuous grain ing without rotation or manuring for ten to fifteen years, had lost a large part of their humus and nitrogen, and in consequence, had become greatly educed in fertility.

Notwithstanding the recognised importance of this

ant of soils, little has actually been known mutil cuits recently of its chemical composition and epties. Within the past year, however, Schreiner his collegates of the United States Bureau of Soils have reported the isolation from the organic m mous arre reputed the isosaton from the organic mat-ter of the soil of no less than twenty complex organic compounds, some of which appear to be toxic to plants and may explain the so-called "sick" condition in soils

Chemists and Physicists have also been very active recently in studying the soil solution. This solution is the say or life blood of the soil and the carrier of od to the plant. The ultimate yield of plants de pends upon the composition and concentration of the soil sofution and the rate at which it supplies the plant with food at different stages of growth. If the becomes poor in plant food the plant pines and dwindles. If on the other hand it becomes too rich in plant food or surcharged with deleterious sub stances, as in the case of alkali soils the plant will also suffer. A moderately rich soil solution, the con-centration of which is steadily maintained, is that which is most conducive to normal, vigorous plant growth. If soils are not naturally capable of maintaining such a solution, they must be made so by judicious use of manures and fertilizers.

Soils become unproductive and are said to be "ex-austed" or "worn out" when the fertility has been reduced to such an extent by washing, leaching, crop

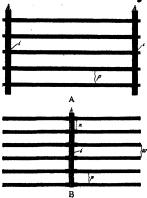


Fig. 2.- Types of steam sterilizing apparatus for ouse soil. Inlets for steam at i.

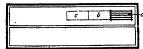


Fig. 3.—Plan of green mhouse, showing method of

as a result of unfavorable physical conditions than from any other cause. In such cases the soils are frequently referred to as "out of condition" The soil investigator endeavors to determine the physical condition of soils by means of mechanical analysis, which separates and measures the different sized particles, sand, slit, clay, etc., and by studies of the tex-ture and structure of the soils with reference to their behavior toward heat, gases, water, and solutions Probably the most important single determining facto in the productiveness of soils is water, for plants or not grow without a sufficient supply of water in the soil at all stages of development. Water is not only an important constituent of plant tissue, but as al Water is not only ready indicated it is the solvent and carrier of food in the soil and in the plant. For each pound of dry one soil and in the plant. For each pound of dry matter produced by the plant the soil must supply 250 to 500 pounds of water, a large proportion of which, however, passes into the air by transpiration through the leaves, and from the surface of the soil by evaporation.

Soils vary widely in their capacity to absorb and retain water, and it is upon this that their adaptation to crops largely depends. Coarse sands have little retentive power for water, while clay soils absorb and retain a large amount. Organic matter (humus) increases the absorbent power of soils for water Plants, however, will utilize a larger proportion of the water in sandy soils than in clay or humus soils Ordinary crop plants will not grow normally in saturated (water-logged) soils, the most favorable amount of water being from 40 to 75 per cent of that which the soil can hold when completely saturated A wet soil is cold and therefore unfavorable to plant growth

Many careful studies have been made of the exact amounts of water required for the normal growth of various crops on different kinds of soils. Fig 1 il-lustrates apparatus and methods used with very satisfactory results for this purpose by Prof. Samuel



Fig. 4.—Sell sterilizers for tobacco plant beds. Part of an elaborate equipment with overnment experts are experimenting for the benefit of tob



Fig. 5. -- Various special forms of apparatus employed in soil investigations in laboratory of the United States Bureau of Soils.

ping, and improper methods of culture that the soil solution no longer renews itself sufficiently fast to supply the demands of vigorous crop growth. is, however, no such thing as exhausted or worn-out soils in the true sense. Soils become impoverished so that they are no longer profitably productive, but never exhausted to such an extent that they may not be restored to productiveness by proper methods of tiliage, rotation of crops, and manuring. The fact is that the highest level of production is often maintained on soils which have been longest under culti-

As already indicated, soils are semetimes rendered unproductive by excess, as well as by deficiency, of soluble constituents, as for example, in the case of alkali soils occurring in regions of deficient rainfall, which are made barron by an excess of the same salts that are found in greater or less amount in all soils and give them their fertile qualities when present in

per preportions.

yearlogally unproductiveness is due to excess of
constituent ever another. For example, Loow
ethers aftribute the unpreductiveness of certain
and teach constituent over another. For example, Low-therm spiriture the unpredent present of certain to an excess of magnetic over lime, and teached fairs are less definite spits used to make the magnetic of the constituents in order to secure the provide of the constituents in order to secure the provide of the constituents are of the constituents.

free lime mus-select Silver top F. B. Guthire save shows that Inciden said Americable sellector incidence

unproductive by the presence of excessive amounts of magnesia.

Soils probably more frequently become unproductive



Fig. 6.-- Apr operatus used for ext on solls in the inherate

Fortier in irrigation investigations for the United States Department of Agriculture By applying different weighed amounts of water to a series of sunk to their tops in the soil and withdrawing and weighing them from time to time in the manner indicalled in the figure, data are obtained as to the amounts of water giving the best results in crop yields and of that lost by evaporation.

It has been found that the amount of water required by plauts is controlled to a large extent by the soluble plant food in the soil, i e., plants require less water on soils whose solutions are abundantly and constantly supplied with plant food than on poor soils whose solutions are deficient in plant food—a fact of great importance to regions dependent upon irrigation or subject to droughts. To utilize a scanty supply of moisture to the best advantage the farmer must keep his soil rich.

However, the soil is not a dead mass controlled en-tirely by chemical and physical laws, but, as the great Berthelot declared, it is a living thing It is the scene of the activities of living organisms (bacteria) which have a most important influence upon its fer-tility. In the soil, as in the animal body, beneficial and harmful organisms are constantly struggling for supremacy. When the latter gain the mastery, fertility declines and the soil becomes sick, when the former prevail, the soil is healthy and its fertility is enhanced. There are organisms in the soil which increase the store of nitrogen by fixing the free nitrogen

(Continued on page 186.)



IN all the history of empire building there is no chapter to compare with that which trils the story of the development of the great West from a vast stretch of prairie, desert and primeral forest into the richest and most extensive openicalismal empire in the world. The rapidity and completeness with which this transformation has been reflected are chirfly due to the invention of agricultural machinery of world present of the property of the

Have you ever made the trip from New York to Prisco? Did you ever get a whiff of the Western cosone, and did you ever get a whiff of the Western cosone, and did you ever get as the grim out-posts of our Western progress and survey the ever widering fields growing ripe with the harvest? Unless you Lave journeyed across the great continent that lies between the Atlantic and Pacific oceans it will be difficult for you to understand what a wealth of agricultural resources we have, or to what degree they have been developed. In this fair land of ours, we now have approximately 700,000,000 acres of land under cultivation, from which in 1910 we produced \$8.328.000,000 worth of cross

The story of this stupendous development is largely a story of the development of agricultural machiner, and it is the purpose of the present article to show what great results have been accomplished by the introduction of a few notable machines among the many that our great agricultural machinery establishments have placed at the disposal of the farmer.

TRACTION ENGINES ON THE FARM.

Of all the progressive elements which go to make up our peculiar American civilization, perhaps the American farmers are the most conservative. In rare instances do they jump at untried things, but also in equally rare instances do they let an invention of proved value get by them. In the good old days of the early reapers and binders, our grand-In the good old fathers had a merry time watching the contest of the inventors and manufacturers of these machines in their efforts to establish their worth. They scoffed at who would not?-but when once convinced they accepted them as their own. And the \$9,000,000,000 crop of 1910 is a testimony to their wisdom. Newer and later improvements in this field have run the same gauntlet. The cream separator was rejected until the big dairies came to its rescue. Manure spread ers were received with doubt until the government tests substantiated their value. And now it is the powerful gasoline tractors which are in the limelight At every big fair and concourse of agriculturists these overy one rain and concourse of agriculturists these machines are made to "show off" at plowing and hauling and threshing like champion strong men. Sometimes a dozen or more are in the same field at one time, chuschugging at each other in a very That this chug-chug is going shortly

to revolutionize the heavy horse work of farming seems certain, as some of the records of these engines are nearly as miraculous for their speed and chaspness as compared with the present methods as the uld-time respers were compared with the cradle and sickle.

American farmers are selving the labor problem. With the opening up of the huge wheat lands in the West, the new settlers have laid violent hands on the labor-aving truction engines used by their neighbors and are calling them their own. At first the powerful noisy ateam outils held swap, but as they were soon found to be suitable only for the very large farms they are fast giving way to the lighten, cheaper, and handler gausline tractor. These tractors are so incepensive in their maintenance and can be used for so many different purposes, that they are doing more than any other single factor in straightening out the labor difficulties of the Western farmous and when the remarks. These aggressive, business-like ploneers have taken the reins in their own hands and where they could not get assistance in their time of need from human beings they have turned triumphantly to the greater power of machinery. It is no uncommon thing for a farmer with only a gasolina tractor to tackle single-handed a ten-acre sidel, plaw it, harrow it, and roll it all in one day, at a cost of from 40 to 50 centle per acre. Under the old swar, with men and horses, it is estimated that it would have taken the mea and twenty horses to do the same work in the same time and the vost of the plowing alone would have been \$1.13.5 per acre.

At harvest time this same karmer takes the same emblose.

At harvest time this same farmer takes the same engine and draws two or more harvesting machines, thus eliminating the expensive man and horse hire of the old-fashloned "three horses and a man" outfit of a few years ago. Later in the season, when it comes to threshing, he

Later in the season, when it comes to threshing, he can use the tractor to operate a threshing machine. He thus frees himself entirely from the annoyance of waiting for what is known as "oustom thresheers."

Finally he standed his tractor to a number of wagons and shalls he produce to the nearest sievator or rational standard his standard hi

up steam—no hauling of foal or wises. We design of fire—no cost scope when it of actual spiralizable of the Belween, seasons that emplies mesh, no. 1888. Belween, seasons the emplies mesh, no. 1888, where seed the principle of the seasons of the seasons shredder, rests the feed gridely, and then the follow which on the more writtening of the seasons follow which on the more who the seasons are the the left of the man who tills the soft.

That these engines have come to stay made to proving. They have threshed thirage, as did the American harvesters of a quarter of a century ago, where the white the truther is to be in Europs is still problematical; but in the Aspentine, in the United metals in the United metals in the United metals in the United measurement of Canada, they are silling a material and harvesters, the there was the contract of the first metals and harvesters, the they have come to the pild of the farmers who were wont to let half of the farmers who were wont to let half of the first hand go untilled because who were they could not get men to work for them. They one have come as an elevanth hour succore to the farmers in his eyes, watched his ripcised of the problems of the strength of the

Given a few more years of education and experience, and the constant chusching of the giaseline tractor will have drowned the cry of the West for men to save the crops. It will sentralise the heljra of young modification of the education of drifting to the eties of the East, and will add another step toward increasing the production and elementing the price of the food supply of the world.

THE CORN CROP.

The United States produces seventy-eight per cent of the world's corn crop, more than 100,000,000 acres being devoted to the production of this cereal.

Until a few years ago it was commonly supposed there was very little value in cornstalks, and no one dreamed of the neglected fortunes that lay concealed in the snow covered cornfields.

Most of us have vivid recollections of our hoyhood days, and the hard work which attended the gathering in of the eern crop, it meant long hours, hard work, and bruised hands. Huskers' gloves and husking pegs wore out just when they ongth not, and tender hands received many scratches that sometimes developed into serious wounds. Corn harvest meant a tiresome, trying time. Those days have meant at iresome, trying time. Those days have passed along with a good many other days of drudgary that illed to characteries life on the farm. Of course, there is an it meant on the materially lightened by the use of modern machinasi. Here is no reason why the farmer, who admittedly belongs to the most proparous class in the country, should don't himself anything which will make this life easier and add to the grout he can second

cores from hist acres. The records that have been obtained in this remarkable vacuits that have been obtained in this sentilage are the to the fact that this prices of the province occurs are presented in the site is actively from 17 norm in harvested at the right time, the face if most too right, that change from the mobile of the insolution form is present, and the freder commits insolution form is present, and the freder commits in the price of the price of the frederic comtains a result temper regular form, and the frederic comtains a result temper regular form, and the first in fact the rights or have been the complete for the fact that intensity or have been form to provide the price of the manufacture of the content of the contains and the content of the content of the fact to manufact them is the content of the manufacture of the manufacture of the price of the content of the content make most often in the content of the manufacture of the manufacture of the first provides the price of the content make most often. profiles ther and the footder becomes hard, tough, and segmentable to the stock. When green corn is cut and there's not not segment earlier will set it, stalks and sit, it preference to the grass, and fatten on it. Overlay, shaden, however, is, not much better than straw. When corn is out by hand, a man can not cover there there there is not cover the corn before it is possible to save it all with the corn binder it is possible to save it all with

While corn is out by hand, a man can not cover sings; than a few areas, at the right cutting asseon.

With the corn binder it is possible to save it all with the care binder it is possible to save it all with the sizes save sear that a practical farmer gives to his timethy or clove. The save do not shrink when the corn is cut and sheeked at this oritical time, as they save with fodder in the shock the same as though left signifiant, and the yields of the corn to the care will signifiant, and the yields of the corn to the care will sho, so large as though it may be save as the same shad in the present which the farmer with the present which the farmer out is given to the fact that it enables the farmer out is given to my life out hand labor, and at the same size it gives him a crop of fodder which is equal in feeding while said founcing to a crop of hay from the manne land. It gives two cropes tratesed of one from the isomatical, and the second crop, the fodder, is the major implicable of the two because it costs nothing to

This own blader is the great triumph of the opening pains of the 30th century. It gives the farmer a successive of the 30th century. It gives the farmer a successive the farmer as the farmer as the farmer of spring to the last corn row in the fall. It is an achievement which has tried the mettle of hundreds of investors, for corn is a study horn corp which seems to take a delight in baffing

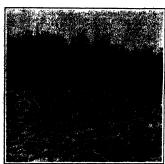
the investors who seek to build corn-harvesting machines. Not many years ago it was a common saying among the men who were experimenting with corn binders, that anyone could build a machine to cut mice "Bunday school corn," where the stalks all stood up straight in the rows, but that the real test where inventors falled was in trying to handle corn so that the crop might be harvested under all the conditions in which it is found at cutting time. This was the test in which the corn binder proved the

Standing up to its work, the machine moves forward straddling the row, the long dividers which project forward on each side of the row pick up the down stalks, and the gathering chains lift them up into a vertical position. The corn is no: carried back through the machine, strictly speating, for the mechine moves forward and gathers the corn into bundles as it cuts much as an might walk forward dies as it cuts much as an an might walk forward in his arms and cutting it as he went, with knives statached to his seet. In this manner the corn is attached to his seet. In this manner the corn is attached to his seet. In this manner the corn is attached to his seet. In this manner the corn is required to the seed of the see

It is about forty years since inventors began to dream of a corn-husking machine, but it is only within the last fifteen years that practical machines have been available for the farmer. So long as the husking of the corn was the only object sought, there was no read demand for those machines, because the farmer could not save enough labor to warrant their use. Since the electropy of corn fodder, and the equipment of these machines with shredder heads to shred the fodder, the demand has grown rapidly. The strains to which a basker and shredder are sub-piected, especially from handling heavy corn, are very severe and the strongest and most scientific construction is required to make a desirable machine. It was not until firms having large equits had taken held of the problem and had brought all their technical skill and experience to best this! It was possible to the farmers to obtain a moderate pried machine that would give them entire satisfaction. The owner of a large farm, can club together and buy a machine which have a sub-piece to the same of the control of the problem of the product of the problem of the product of the problem of the country of the control of the product of the problem of the problem of the product of the problem of the product of the problem of the product of the problem of th

DITCHING AND EXCAVATING

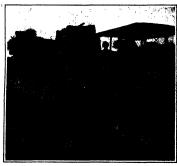
Another operation in which machines are called to the aid of the farmer is executing and trench digging. The performances of some of the mechanical excavators on the market are very wonderful Not only do they far surpass hand labor in speed and economy, but they will successfully cope with soil which is practically unmanageable by hand. Any



The corn binder cuts the corn and binds it into square, butted bundles which stand up in solid shocks.



Traction plowing. Note the straight, clean furrows.



Twenty-horse-power traction engine hauling two wagons loads with ectton weighing 15,000 pounds.

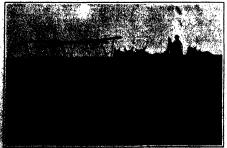


Plowing and seeding at one operation by traction engine power.

A typical scene in the West.



This manure-spreader in five minutes will scatter a full load of manure from the rear of the wagon.



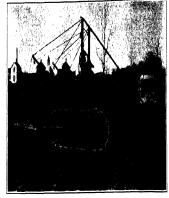
factor trader (topos posting machine) cutting a U-foot swath,



The husker and shredder - one of the greatest labor-saving machines ever invented

MINIMARICAL HELPMENTS OF THE PARMER.









A disk plow at work leaving a concave furrow.

A resper and binder pecking in an awkward position on a billiside.

A drill used to plant seed.



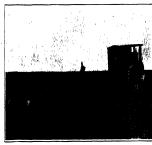












A combined harvester at work on a farm near Willows, California.

This outfit broke 2,600 acres, packed and disked it, at an average cost of \$1.22 per acre.







A rest view of a tractice ditches, showing setting wheal.



A stone plow could employed in the Judith Barin, Montana.



Crushing and sacking barley near Willows, California.

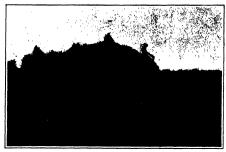


Portable gasoline engine driving elevator which loads corn into the silo.



The second of th

Traction engine drawing gang of plows and a pulveriner.



This machine loads the hay onto the wagon behind which it is being drawn.



Gang of disk plows drawn by a traction engine.



Traction engine hauling a battery of farm implementa, SOME OF THE ENGINES THAT MAKE MONEY FOR THE FARMER,

ground that can be loosened with a pick can be excavated with a mechanical excavator

The machine will cut through bardpan or shale or frozen ground, in which profitable picking by hand is impossible. Thus, for example, in street excavating, old macadam rendways are cut through without the least trouble. Such a machine will make its way through a log of timber buried in the ground. If, however, the cutters strike a buge boulder, too large in diameter to be taken out of the trench, the wheel of cutting buckets must be raised out of the krench in diameter to be taken out of the trench, the wheel of cutting buckets must be raised out of the krench to loosened by hand, picked up with a chain and raised by nower, for the machine vannot, of course, cut through boulders. There is, however, no danger of breaking the machine when it strikes a boulder, as tag cutting wheel is mounted between two beams that can be raised when a severe obstruction is encountered, permitting the cutting feeth to pass through them. At the worst, if the cutting teeth catch in the obstruction, all that would break would be a cutter.

bolt or a chain link, which can be quickly replaced. The machine will excavate any boulder that is not too large to enter the buckets.

MAKING THE ACRES MORE FERTILE.

The manure spreader is another addition to the new culpiment of the farm. The increase in oropy values from machine spreading is very large. Fresh machine-spread manure has caused the soil covered to show a gain of 22.8 bushels of corn per acre. This, say at 10 cents per bushol, amounts to \$15.50; twenty acres would total \$358, and every feature every year can put this down to profit or less. It all depends on which way he is going—the old way or the new.

The greatest savings have been left to the last—the savings of time and human strength, and the boys on the farm. If takes a pretty strong man to spread a load of manure in thirty minutes; it is a pretty poor manure spreader that can not do the job in five minutes. Time is money to all but the extravagant.

If has been said and with much truth ore so it some

times seems, that "everything is held dear but human life." This seems, or has seemed, doubly true, of life on the farm. More lives have been actually wern out on the farms of the country than in all other fises of endeavor combined. The farmers have not been stilled outright, as on railroads and in mines, but they have been worn and bent, and sapped of energy. Happily this condition is passing. Improved machines and a greater knowledge of the ways of doing things are working the change.

are working the change, and the same contributing to the same and profit and happiness of the farmer, none is more conspicuous than the manure apressed. It is taking the strain from the bank, the blisters from the hands, and the general disagreesslement from the hands, and the general disagreesslement from the whole job of apreading, and in their stead is giving the young man on the farm a reasonable willingness to stay there. Health, strongth, and contactment are the assets of life A machine that conserves these is the next thing to the Fountiers of Fynth, which, Prone-ds Leon looked for but never found.

The Farmer and the Weather Bureau

The Latest Chapter in the Story of Practical Meteorology in America in its Applications to Agriculture and Horticulture

By Charles Fitzhugh Talman, Librarian, U. S. Weather Bureau

THE ARMY SPIRIT.

THE earlier chapters of this story have been written, not once, but a hundred times; so often, in fact, that i am going to dispense with the customary "synopsis of previous chapters" of the writers of serials, and plunge at once into my narrative
The national weather service, once a branch of the

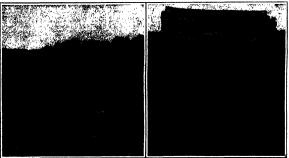
army, was separated therefrom for several reasons, only one of which is pertinent to the present story. The act of Congress that established the Weather Bureau as a civil branch of the government provided in so many words, that it should "be hereafter spe-cially developed and extended in the interests of agree rulture." The removal of the Weather Bureau, in 1891, from the War Department to the Department of Agrifrom the war Department to the Department or Agri-culture—from Mars to Ceres—was possibly one of the most conspicuous examples in history of the process described by an apostle of peace who ante-dated Nobel prizes: "They shall beat their swords

into plowshares, and their spears into pruning-hooks.'
Taking the "plowshare" to symbolize agriculture to symbolize agriculture and the "pruning-hook" horticulsure, we have in these words an epitome of the paramount duties that dewords an epitoms of the paramount duries matter volved, in the year 1881, upon the Weather Bureau of the United States Department of Agriculture. Passing over the twenty years that have elapsed



Fig. 1.-One of the army of six hundred in action

Weather Bureau observer at Grand Junction, Col., rushing a fixed warming to the fruit growers of the Grand Video. With only a messenger box to add him, this soldier of the government slittle meteorological army is detailed to guard one of the fait st fruit-growing region of the West against the hemoslows of Jac. Frust.



Photos by W. E. Bonnett, Freeno, Cal.

Fig. 2.—An episode in the raisin industry in California—before and after the Weather Bureau has predicted "showers."

Imagine each of these pictures multiplied many thousand times. California produces over 103,00,000 pounds of raising every summer ratio is predicted the community terms out on masse to stack the trave as shown in the right-hand figure

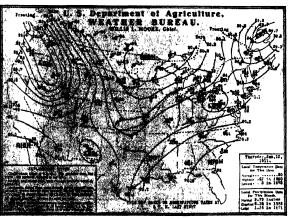
since the event invariably referred to, among the initiates of the service, as "the transfer," let us see how well the Bureau is fulfilling to-day the duties especially enjoined upon it by Congress

Relieved of the incongruities that hampered its progress under military administration, the Bureau has nevertheless preserved military traditions. Its discipline is still rigorous; its esprit de corps admir able. Habits of promptitude and obedience formed by military service clung to the men who, in 1891. were made civilians by Congressional enactment, and have been handed on to their juniors. It is no disgement of the other scientific and humanitarian branches of the government to say that, in compari trances of the government to say that, in comparison with them, the Weather Bureau is especially distinguished by the co-ordination of its employees and their subjection to central authority. The disciplination of the prevails in the Weather Bureau is possibly the most striking trait of this branch of the public service, as it is certainly the one that makes most for the effective discharge of certain arduous duties which will be adverted to in the following paragraphs

It would hardly be a figure of speech to say that the Weather Bureau, an offshoot of the United States Army, is to-day a little army in itself, or rather two -a field army of six hundred men.* widely scattered over the land, and a staff corps of two hundred, on duty at the headquarters of the service. It is of the is bundred men in the field that we first write

These men are, for the most part, on outpost duty; one here, two there, rarely three or more sharing the responsibilities of a single post. They are, all in all, a body of earnest and hard-working men, taking themselves and their work very seriously and little con cerned with the hasty and ephemeral judgments of outsiders as to their value to the community. They are outsiders as to their value to the community raw are not, in the great majority of tases, stands, and do not pretend to be. Some of them are men of medio-cre education, judged by academie standards. They are practical men, not in the sense of scorning knowledge in the abstract, but in the capacity for applying all the knowledge they have, and for entering into a sympathetic understanding of the everyday needs of humanity. It is too often the case that when the public crayes bread, science offers it a stone—pos-sibly a precious stone, from the point of view of the intellectual gem-collector, but one that is both heavy and indigestible as a substitute for the staff of life It is conceivable that if the field force of the Weather Bureau consisted entirely of Ph D's, the net result of their utilitarian labors might be less valuable than

The unwritten history of the Bureau contains in-numerable instances in which the soldiers of this little army have displayed rare courage and fidelity under trying circumstances, and very few in which they have been found wanting in these qualities.



The farmer who lives near enough to a large town to receive the newspaper map a few hours after publication need no longer depend upon the igns dissil of the official forcessier; the weather of the whole country is laid before him and he may draw his own conclusions

And the state of the second of the second se

It would be a congenial task to chron of these instances, if it did not lie beyond the purview of the present narrative

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The officials and employees who man the two hundred regular stations of the Bureau are striving to make themselves useful to the community, even beyond the letter of the exacting commands laid upon themwith what success we shall try to se

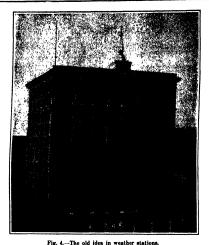
WHERE THE FORECAST FAILS

Let us suppose that Farmer A wants to out his hay and is concerned about to-mor-row's weather. He may have his own opinion as to the prospects of sun or rain, founded upon local indications which he Interprets according to his lights. Nevertheless, he seeks the opinion of the Weather Bureau, by way of the telephone. Here we must embastic the fact that he can get the weather forecast by telephone from the local exchange though the latter may be hundreds of miles away from the where the forecast originated This in itself is a signal example of the thorough way in which the Weather Bureau has organized the system of distributing its in-formation. There is no need for the farmer to have recourse to "long-distance" The forecast is sent every morning, at govrine torecast is sent every morning, at gov-ernment expense, to the telephone exchanges throughout the land, and to-day 3,881,000 telephone subscribes can get it in half a minute by merely calling up "central"

We will suppose that in this particular case the forecast says, "Fair"—which means no rain worth mentioning A little sprinkle is neither here nor there. Our farmer accordingly cuts his hay next morning. The day waxes hot, in the afternoon thunder clouds gather, and Nature relieves her over-charged feelings by weeping copiously all over the farmer's meadow Nature te often very partial in her attentions, and it may be that Farmer B, who owns the adjoining meadow, escapes the drenching al-together Within the "forecast district" there are no general rains--only a local shower here and there- and the forecaster congratulates himself that he has hit the mark. Meanwhile our disgusted farmer is using language regarding the Weather Bureau that it is not for a mild-mannered

bibliophile to record

Well, then The general forecast fails to fit the particular case—not once, but often The local shower—particularly the thunder shower-is about the most uncertain quan-



Its location is not ideal from a scientific standpoint, but was the outcome of practical requirements. Most stations are still of this type,



Fig. 5.-The new idea in weather stations.

In the new government owned buildings of the "observatory" type, the instruments have a more satisfactory exposure. Forty-lye of these buildings have been created.

tity the forecaster has to deal with. thunder shower is not a mystery to mod-ern science; it has been dissected and classified, and its life-history has been written. There existed until very recently an international commission for the study of squalls and thunder storms, and there is a Fr savant-M. Durand-Gréville-who has devoted his life to the investigation of this particular branch of meteorology. We know that summer thunder storms, as a rule, move across the country in a long line like an advancing army marching "company front," and the position of the line has a more or less definite relation to the position of a general area of low barometer In the light of our present knowledge there is a perfectly feasible method of forecasting the occurrence of such storms in a particular region, which consists in employing a gr corps of special observers, stationed at in tervals of a few miles from one another, and keeping a forecaster at some central point informed by telegraph or telephone of the behavior of each storm. With such an organization, after a thunder storm or a line of thunder storms had once begun its march 'cross country, its progress from hour to hour could be predicted with reasonable acand warnings issued accordingly Such a plan was recently tried in Germany in connection with the Aeronautical Ex-position at Frankfort. The city was sur-rounded by a cordon of 85 special observers, each of whom was instructed to send an urent message to Frankfort whenever a thunder storm made its appearance in his neighborhood. So efficiently was this programme carried out, that no one of the thirty-seven thunder storms that occurred during the three months of the exposition took the aeronauts by surprise. On a small scale, and for a special occasion, this method is. in a densely settled country, not only practicable, but relatively inexpensive Each of the Frankfort observers received for his services a season ticket to the exposition, and the entire cost of the undertaking, including telephone and telegraph charges, was only \$150—rather cheap insurance on scores of valuable aircraft and more valuable human lives On a scale large enough to fuifill the requirements of a national weather service such a plan is out of the question, for many

Then there is the thunder storm recorder, in its various forms—ceraunograph, ceraunophone, electroradiophone, and what not.
(Continued on page 187.)

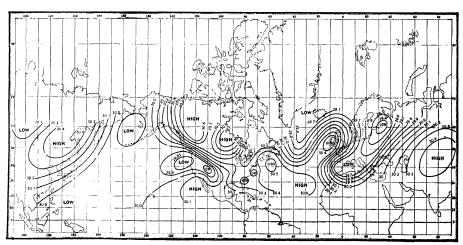


Fig. 6.—A splendid vista the daily synoptic weather chart of the northern he nisphere. (Chart of January 18th, 1911.)

eter in mit Shoria to a bilazani in Noraka, a heavy fall of mow in the Oble valley, or a from in the Plerida omang grows seems a far igns. Whileh the memory of mor rill in triet prime the vista of the weather forecaster was enlarged, with the act of the testeroid, to one to the one shows nowed farbon a recycle in Washington. The reports of foreign stations are received to quide. Unput the basis of its day. Its terms are general, and the engirted pranciples upon watch it is under our rill in an eavy stage of development; the sejecutive of games the conditioned or lawery preclaim are throughout the country. The weathy gradulum papers are gold to give their readers the to

The Small Motor on the Farm

What it has Contributed to the Farmer's Comfort

By L. W. Ellis

A HUNDRED years ago the production of the necessities of life kept four families out of five on the farm, and those four barrely supported the fifth by their surplus products. Choice of occupations was necessarily limited Slince the invention of the steam engine, the manufacture of countless necessities has been transferred from farm to factory. The steam engine has made possible the wonderful development of our land and water transportation system. It has fostered the growth of our great centers of population, increasing the opportunities for employment away from the farm. The transfer of manufacturing to the city and the development of wonderfully off-diesth horse-drawn field nachinery for crop production released millions of workers from the isolated life of the country. In consequence we have had for a generation the problem of making farm life more attractive.

It has remained for the engineer to accomplish what the agriculturist failed to do, and, naturally enough, by the same methods by which he made life away from the farm attractive He is establishing easy means of communication and transport, devising conveniences for the farm home, and, most of all, he introducing mechanical power to take from human shoulders the monotonous daily tasks that cannot be shifted to those of the animal. The agricultural world is awakening to the stunning fact that, after all, the farm is an engineering proposition Production, to be efficient, must be organized on the same lines as in other great industries The small motor is only the beginning of a wonderful development in agricultural engineering, and has greater significance than the importance of present installations would indicate It is significant of the tendency to intensify agriculture by applying more power to each acre and carrying pro s farther on the farm It means the elimination of drudgery, the saving of unnecessary human labor, which is conservation of the highest type. It means the opportunity for exercise of mental rather than physical strength, the development of broader intelligence on the part of our farmers, with direct benefit to those who must depend upon the farmer's efficiency for their daily bread

Blectrical machinery has gone through wonderful development, and competition in commercial fields has at last brought the farm to the manufacturer's attention as an unworked source of trade. One of the papers at a recent meeting of the American Soriety of Agricultural Engineers was read by the representative of a large electrical concern, the title being. "The Promise of an Electrical Agriculture." The resulting discussion developed the fact that both engine and electrical manufacturers are looking to the farm for their greatest volume of business in the near future.

Without dwelling further on the economic phases of the question, we may pass to a consideration of some of the many adaptations of internal combustion engines and elseviries motors to farm purposes. The discussion will be confined to those operations involving the saving of hand labor, the use of mechanical power in field work being a vast subject to itself.

The uses of the gasoline or kercesene engine on the farm are almost without number, but only the exceptional farmer has established a complete power plant Pumping water by hand has long been regarded as impracticable, and in regions of unbroken thoography the windmill has been generally unreliable. The latter frequent failure in the summer, the time of greatest consumption, has led to a surprising shift to the small engine for pumping purposes

In sonaral the needs for water are for fire protection, sanitation, trigation and consumption by household and stock. By the sild of the engine the farmer may have a better water supply than his city relatives. For instance, an elevated storage tank will give gravity pressure for fancets or hydrants all over the farmstead, and the newer pneumatic tank, underground, gives both pressure and insurance against pressing. In the latter the engine may be used to pump either air or water into the tank up to a pressor of from it to 75 pounds of an engine, a compressed tank and a submerged pump, to have abundant water direct from the well by simply turning a cock in the fitchen. The pump, located at least six feet under the water, may be started by turning the faucet, the art supplying power for operating the pump. A surprisingly large percentage of farm houses are being equipped with modern sanitary conveniences which contribute to the health and comfort of the family. The engine has solved the problem of trigingtion in

many square miles of semi-arid territory where large projects are not possible or have been delayed Asrule the engines used are of larger size than those used for general farm purposes, but in numberless instances the engines of from three to ten horse-power has proved the salvation of the farmer by supplying water for al lesst a small field.

Water can often be found at a shallow depth in dry runs or by boring A five horse-power engine will raise 500 gallona per unhunte from a depth of twenty feet. Even in the favored Combelt and the East the engine is being called on to keep crops forging alread through the customary summer drouth

Too often the only use of the small engine is for pumping water, or grinding feed, or some other one task. In contrast the writer has in mind a two-story power house on a side hill, visited over three years ago. The engine and pump are in the basement Overhead is a line shaft, to which are attached at will the cream separator and churn, the washing machine (the boys do the washing and like it, because there is some in spiration in the chug and fuss of the engine). the corn sheller, fanning mill, feed grinder and grindstone. To all intents and purposes the building is a small industrial plant. There the farm office is located, the farm business transacted, the bulk of the farm stores kept, and many of the important processes of the farm carried on. All is system like that of the factory. There is activity whould fusingly, the condition in any occupation which begets enthusiastic service.

Out in the dairy barn one clean, well-paid, trained dairy assistant now does the work of two slovenly farm hands openly rebellious at the tiresome job of milking All that the farmer saves in money, perhaps. is the keep of one man, but in freedom from labor troubles and in general improvement of dairy conditions he gains in reputation and satisfaction of mind The vacuum milking machine is responsible, with a gasoline engine off at the dairy house energetically minding its business of running the vacuum pump and the cream separator. Ten to fifteen cows per man per hour is the new standard of capacity, with s work and dirt The vacuum cleaning ciple is applied to the cows by a slight addition to the equipment. All the dirt, loose hair and other foreign matter can be drawn off into a dust collector and removed By the ordinary process of currying and brushing, these sources of contamination are stirred up to fly about the stable and settle upon the utensils In dairies of fifty cows or less an engine of one and one-half horse power is sufficiently power ful to run the four to six milkers usually attached and to handle other dairy machinery besides

The livestock is rid of its surplus of old hair neatily and rapidly through the agency of a power clipping machine and a very small engine. The engine may assist in spraying the cattle for parasites, whitevashing and spraying the interior of the harn as a prevenitum ensure. Spraying now extends to the orchard also, where insect and fungus enemies are successfully combated.

Filling the silo has rather grown beyond the limits of hand work, though it started in the same class with the work of chopping roots, cron, grasses, etc., by hand All this work, heavy or light, may now hoo no by the gasoline engine, and the number of silos has increased in thirty years from less than one bundred to many thousands One of the ascompanying illustrations shows an engine of about twelve or fifteen by the property of the contraction of corn fodder per day on ten to twelve gallons of gasoline.

gasonine. The internal combustion engine for such work must have an excess over the average power requirements, as the load is irregular and the speed must be kept up in order to obtain efficient results from the ensilace cutter. On this account a havay fly-wheel is added to equalize the motion of the engine. Again, some manufacturers, following the lead of the builders of large gas engines for heavy duty, are adopting the volume, or thorttling, governor in place of the hit-and-miss type. In the latter the exhosions are occasionally "cut out" by automatic action of the governor when the speed increases show the normal, to be resumed again when the absence of power impulses causes the speed to drop below normal. The throttling governor admits a charge for each cycle, proportioning it each time to the needs of the load. It is, therefore, slightly less economical on light loads than the hit-and-miss type, but for the heavy, irregular work of shredding corn, filling the silo, sawing wood, etc., it can be depended on to furnish steadiler power.

"Bucking wood" no longer has its terrors for the farm boy. If the farm cannot afood the investment in a saw to go with the gasoline eights there is very apt to be a neighborhood saw. Wood is not a period, able product, however, and farmers are often content to wait until the owner of a large outility part, in an appearance and does the work on a custom basis.

One of the most exhausting choices in consection with the harvesting of the corn crop is shown they on the load after a day of ten or twelve house in the field Nos a two-borne-power (assolite engine, at lard hed to a portable elevator, will empty a thirty bushed load of ear corn into a car, coun crib or gramar vin from three to alk minutes. The same is true to some extent of the small grain crops. Quite often both elevator engine are mounted on the same truck, and in connection with the large threshing outfits this combination saves labor that is hard to get just at that time. The wagon is driven into position, the front when the clevated and the rear end gate removed. The grain falls into the hopper, is elevated by an endiess conveyor and delivered by a facthle spout at heights practically impossible by hand. The engine has therefore made it jossible to build granaries and corn cribs higher, at a considerable saving in initial expense per unit of storage space.

On farms where heavy machinery, portable buildings, etc, have to be moved frequently from place to place the portable gasoline engine equipped with a which and cable is often indispensable. A five-horse-power engine may occasionally be seen ustring a fifteen-don tractor into a space on a storage floor which would not withstand the combination of weight and vibration produced by running the tractor under its own power

It has been conclusively demonstrated that the horse is a more flexible traction power unit than the gasoline engine. He may be coupled up in teams of vary line engine. He may be coupled up in teams to vary ing size, and in a pinch can pull to many times his normal capacity. At the same time, for driving ro-tary mechanism of fairly constant resistance, the engine has a great advantage over the horse in endur-ance. This is further emphasized by the loss entailed in transforming the linear motion of the animal's for ward progress into the rotary motion of the machine While a school of engineers in France has been arguing that the ideal farm machine should use horses for propelling it and the engine for performing its effective work, Yankee ingcoulty has perfected the combination. From mounting a small stationary engine upon the frame of a grain binder which was done repeatedly by inventive farmers before manufacturers grasped the possibility, we have now come to an engine mounted on wheels and connected by a to an engine monney on wheels and connected by a shaft and universal joint to the driving shaft of the harvester. This outfit goes merrily up hill and down dale with two horses where four or five were formerly employed. It is especially adaptable to cutting rice or grain on soft ground where the traction wheel of the binder could not grip the surface firmly enough to transmit the required power

To the average farmet electricity is a mysterious agent, to be gincered wollt with "I be date the widest use of electricity on the farm is for lighting and for the light tasks about the house." Current for general power uses has usually proved more ceedly than power derived from the gasoline engine, and the kerossene eagine has confurthed increased the handle and Moreover, the engine as a self-outstained and analy portable unit, is much more convenient for use at different points. Its lootated cases however, a small stream has been harmessed, and even at a considerable cost for electrical equipment been made to furnish chapper and more convenient power than the

Improvement in the storage battery has widened the use of gasolin-electric systems. A two horse power engine will turnish a horse-power hour for a le gailon of gasoline on full load and on 0.2 gailon at half load. As many tagks require less than full load the storage battery has been made to economize by tasking up the surplus power. On the average farm it is seldom necessary to run the engine simply to charge the battery, hence the lights may be said to cost little or nothing outside of the cost of installation and the periodical restoration of the hattery electrodes. The storage battery is a great convenience. It is a necessity with the bit and-miss governed engine if a clear, steady light is to be had Some types of engines with throttling governor control have proved very satisfactory when coupled direct to generators. This connection requires, of course, that the engine be run as long as lights are required, and

union some such work as numning necessitates run ning the engine at night, the outfit would probably useful only on large farms where a number of buildings are to be lighted.

Low voltage systems are commonly offered to the farmer on account of safety, simplicity and low operating cost. The improvement of the low voltage tung sten lamps, consuming about one-third the current required to operate the ordinary carbon filament lamp, made it possible to reduce the size and cost of installations, especially in the matter of storage batpopular, as more than that number are seldom burned at one time With this outfit it is possible to wire for twenty or thirty lights, and burn the en tire number by running the engine and dynamos and taking current from the battery at the same time. The fifteen-light outfit requires about one-third horsepower and the thirty-light about three-fourths horsepower, but less than a two-horse-power engine is power, but less than a two-torse-power eighne is seidom installed. The total cost of engine, generator, storage battery, switchboard, wiring, fixtures and lamps, for a fifteen-light, thirteen-voit outfit is around \$400. The light will cost in the neighborhood of \$400. The light will cost in the neighborhood of one-hundredth of a cent per candle power hour. For installations covering considerable area it is advisable to use a higher voltage, i e., twenty-five or

With the development of interurban railways and long-distance transmission lines it is frequently pos-sible to obtain current from the central station at lower cost than from individual plants ties are to be found where the use of electricity for light and power is practically universal, and community central stations are developing in the s manner as did farmers' telephone lines a decade ago.

The installation of low voltage apparatus for individual plants requires radical change in equipment when central station power is finally obtained.

The small electric motor is especially convenient

about the farm house, attached to a fan, a flat iron, a churn or a washing machine, for the housewife h but to turn a switch to secure relief from heat and weariness. The electric range and chafing dish can hardly be said to be in general use, but the vacuum cleaner is coming into its own. For \$100 the mistre of the household is equipped to clean carpets, floors upholstering, drapery, etc., by suction at a cost of three cents per hour. The blowing attachment chases upnomering, oraper, etc., by section as a cost of three cents per hour. The blowing attachment chases dust from inaccessible places. The outfit may be used even for the lady's massage and drying her hair. A motor of one-sixth horse-power furnishes er for all.

A supply of soft water under pressure, independent of the farm supply, can readily be obtained from a cistern, a pneumatic tank, a rotary pump and a motor of one-fourth horse-power. Convenience rather than cheapness has been the means of popula izing the electric motor, and it is only natural that it should appear oftener in the home than in the producing end of the farm

A friend of the writer's even applied electricity to the farm fence. He drove 2-inch × 2-inch sticks about four rods apart surrounding a pasture field and strung two No. 15 wires thereon, properly insulated. As a starter he connected up a tiny dynamo, driven by water power, with his fence wires. By carefully introducing the various animals to the fence before

anels the inventor quit in d This discussion has hardly see of the small internal comjustify the statement that one of the needs of the farm is a comp the subject of power installations. working recolutionary changes in the nomic status of the farm laborer. But there are no state or national publications on farm power questions to compare with the concise, scientific, helpful series on every other topic,

The writer has long advocated the need of a branch devoted to agricultural engineering in the United States Department of Agriculture. On account of the breadth of the subject the State colleges do not as a rule have the necessary resources to investigate all phases of agricultural engineering, and under the present organisation the subject of farm power can receive but little attention. The interests of manufacturer and purchaser are identical. It is gratifying to note that the National Gas and Gasoline En-gine Trades Association, representing the makers of internal combustion engines and accessories, has joined hands with the American Society of Agricult tural Engineers, representing the college men and farm machinery manufacturers, to urge upon Congress the organization of a Bureau of Agricultural En which is so rapidly assuming imp



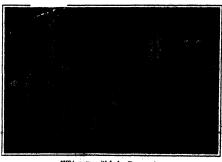
Internal combustion engine fighting the codling moth.



Farm pump engine taking the place of a blown-down windmill.



Mechanical horse clipper in use



Milking cows with hydraulic apparatus.







Starting a Clogged Drain By B. F. Albert

A is near method of starting a flow of water in a wash basin when the drain is clogged is as follows basin half full



Take a swab and work it up and dow water. Take a swab and work it up and down rapidly in the water. This sats up a pumping action that agitates the water in the pipe violently. Nine times out of enit will bring the sediment right up from the trap, and start a flow of water. If flushing is desired, take a cork that will fit the drain in basin, set a hole through it, and attach a piece of rubber tubing to it as shown in the drawing. Draw the other end of the tube over the fauset, place the cork in the basin drain, and turn on the city present. It may be necessary to hold a cloth over the sure It may be necessary to hold a cloth over the drainage holes in upper part of basin. This wrinkle will save dollars in plumbers' bills, as I believe it is ent as a plus

A Talk About Bits By Charles Cloukey

ALTHOUGH the common stock bit is a tool of al-most universal use, there are some sensible and even scientific practices which are little known by the mon run of people who use the brace and bit

There are several different kinds of bits and each kind made for its special use, sithough they are often used interchangeably both through ignorance and be-





Fig. 2.—Using angle brackets to guide the bit

the workman does not have the full equipment

The simiet bit for screw holes, the center bit for the hies of the cabinet and stair builder, the hit for the long holes in heavy timbers the in one need to be drill bit for in quick holes is nort wood, the ex-kinds of helps and odd sized holes in bit for general use and expert

es to may that all kinds of bits i sharp. The drills and gimlets an the selecte as that will reyou marry, the drivin and gimless all an the simulate as that will reall an the similar edge and so hold
force the similar edge and so hold
force the similar edge and so hold
for the similar edge and so hold
for the similar edge and so hold
for a point we request hold. Bits
the similar edge as give them a
force as well and force them a

and consequent labor may be avoided by a liberal application of machine oil in the cut. In similar es when using a machine auger and the work is hard for the belt to pull the work may be modi fied either by filing the threads off the point of the bit or by boring a center hole in the stock with a drill bit just large enough so that the threads will not lead the bit, and still small enough so that the hit will not chatter in the work. If there is no





Figs. 3 and 4.-Guide for cutting half-re

screw feed, the workman can regulate the pressure by hand so that the best will be able to do the work although at a reduced rate, which is the scientific

result of the method

Fig 1 shows the method of marking a piece for boring a hole straight down through and is practised by men who have become expert in the use of the brace and bit.

Fig 2 illustrates the use of two little brackets tacked or clamped to the face of the work in which tarced or clamped to the lace of the work in which the hole is to be bored, and in such a manner as to form an angle in which the bit is to stand until the hole is deep enough to carry true of itself Fig 3 shows a shallow saw cut in the faces of two

es out of which is to be cut a half round groove Fig 4 shows the two pieces in position for boring and the purpose of the two cuts becomes apparent as the lead for the screw of the bit

Fig 5 shows a problem somewhat similar to the last, but is used in such cases as boring a shaft hole isst, but is used in such cases as noring a snart note in a pulley or a bushing where a little space is re-quired for draft. The two thin fillets are placed be-tween the places with their edges just far enough

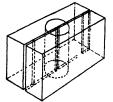
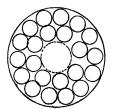


Fig. 5.-Guides for boring a hole in a bushing

apart to form the lead where the hole is desired to be bored It is better to make the bushing of two parts and bore as shown if it cannot be bored first and then turned up afterward

Fig 6 illustrates a practical method of boring large holes by means of the expansive bit The outside circle is the perimeter of the hole to be bored and the dotted line near the center is the solid wood to be left for the engagement of the inner lip and spur The smaller circles represent holes bored with a smaller bit in order to remove the bulk of the wood and relieve the strain on the extension. Care must be taken that the small holes do not cut the core loose from the outside or the attempt will be a failure. The small holes should be so arranged.



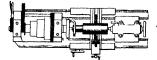
File. 6.-Preparing for a large hore

as to break up the continuity of the radial lines as as to break up the consumity of the radiat lines as thoroughly as possible, said should not break into the trackshif the outer spur if the wood is very hard and tough like hickory, the holes may be quite close to-gether and still hold the estrain of the finishing out, but if the wood is soft and weak there should be more

space between the holes for the reason named Gimlet bits should never be used for the purpose of boring straight center or lead holes as a slant of the grain is liable to carry the point out of line The tool for this work is a very sharp drill bit with little more bevel than is required for hon

Cutting Keyways on a Lathe

It is a simple matter to do som fith work of a shaper or of a milling machine on a lath. For in stance, a keyway may be cut on a lathe. Ither in the shaft or in the pulley by keeping the work stationary and moving the tool as in a shaper way in the shaft put the work on the cent rs and taking a square nosed finishing tool lay it on liners on its side, so that the tool will be in line with the centers. Clamp it in place by means of two bolts. Wedge the dog that holds the work from turning 10



Cutting a

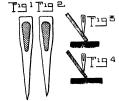
Cutting a keyway in a pulley

that there will be no backlash or play Now throw in the back gearing, and run the tool into the work by operating the carriage back and forth The tool may be fed in at each cut, and in this way a neat may be fed in at each cut, and in this way a next keyway may be planed in the shaft as shown in the first engraving To cut a keyway in a pulley secure the work in the chuck and use a boring tool ground to the width of the keyway and shaped as shown in the illustration The carriage may be run in and out and the tool fed into the work by means of the cross food as before.

Hints on Cutting Stakes

WHEN sharpening the ends of bean poles and other stakes to enable them to enter the ground easily it takes several blows with the hatchet to obtain the desired effect

All this trouble may be entirely done away with f sharpening an ordinary ax or hatchet you first put one sharpening an ordinary ax or hatchet you first put one side against the grindstone and then the other thus



How the ax should be ground for sharpening stakes.

making a bevel on both sides as in Fig 1 But, instead of doing this allow one side of the hatchet to lie nearly flat on the grindstone. Then lay the other side on the stone and put a bevel on it in the ordinary way Now the hatchet has an edge like a wood cutting chisel (Fig 2) When pointing stak a let the flat surface which must be the left aids when the edge is pointing away from you be nevest the wood Lift up the ax and with a slight pressure it drop on the end of the wood stak. It will be found to enter quite easily instead of giancing off the wood as often happens with the ordinary hatchet and the resulting out will be straight as shown in Fig 4, the re instead of being curved as shown by dotted lines in Fig 8

With this edge only half as many strokes and half as much energy need be used over a job and the

se the advantage of being far more work will a neatly done.

Simple Methods of Surveying

ONE is apt to think of triangulation as an ab-Ostruse method of calculation, involving the use of fine instruments and higher mathematics. It is not always recessarily so, for one may often measure distances to inaccessible points, with a sufficient degree of accuracy, with very crude instruments and with no special mathematical effort

Let us suppose, for instance, that we want the dis-

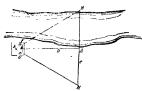


Fig. 1. - Method of finding the width of a str

tance across a river. We will select some fairly conspicuous object on the other side, as a tree or rock at B. Fig. 1, then set up a stake, A, at the opposito point on this side. Exactly in line with A, B, and six feet from A, set the stake C. It is well to use low stakes and drive a small nail in the top of each as a center to measure from Now take a tape line, fasten the end at A and secure—or have an assistant hold—the eighteen-foot mark at C. Take hold of the eight-foot mark and pull both sides tight; which will give us the point D, at which to set another stake being sure not to omit the small nail in the top to mark the exact distances Sight along A and D and have an assistant place a stake at E, exactly in line with A, D and at any convenient distance. If the work has been carefully done the line A E will be exactly at right angles with B C.

Take a board or table, as large as is convenient, place it level and drive a nail directly over the point E; having first struck on it, with this point as a s: naving new struck on it, with this point as a center, the arc F G. Bight across the nail E to the point B, and set up the nail a on the arc and exactly in the sight line Also set a nail, b, on the arc and on the line between E and A. On the arc, measure off the distance b c equal to a b, and set another nail at c. Sight across E c and have a stake set at H, in line with A B. The distance H A will be the same

Now that we have the instrument made we may as well use it to measure the height of that tree we have been arguing about. The instrument, you understand, is the board or table with the arc struck on it. To use it for this purpose it will be necessary to set it on edge, plumb, and with the line between the points E δ , level and pointing at the base of the Set the nail a in line with the top of the tree,

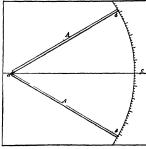


Fig. 2.—A simple surveying instrument.

and then lay the instrument flat, making E b again point at the tree. Measure off the distances A C, A D and D C, 6, 8 and 10, as before, thus locating the line A H at right angles with B A-A being now the tree. Sight along B c and place the stake H. A H will

equal the height of the tree.

If one desires he can easily make an instrument which can be worked more quickly, and which will be accurate enough for most practical purposes. Fig. 3 shows a plan view of such a une, while Fig. 3 sho

A smooth dry board, so cleated that it will not w A smooth dry board, so cleaved task at will say, when we had the larger the better-jud best for the basis, Get out two straight sticks, £2.4, of therecastly seasoned wood, about % by 148, inches. This a nicely made brass or steel butt; and, if the pin is not already loss, file off the end so that it may be removed. Set half of the butt in one and of each of the moved. Set half of the butt in one and of each of the latter of the butt in one and of each of the latter of the butt in one and of each of the latter of the butter of the butter of the butter of the butter of the latter of the butter of th sticks so that the center of the hole will be in line with the side, as a in Fig. 2. On the other and of each of the sticks, which must be of exactly the same length, secure the please of thin metal, 5, setting them in half their thickness, allowing them to project a trifle beyond the ends and using care to have each exactly in line with the half butt at the other

and. Mark the line σ along the center of the base board (see Fig. 2) and strike an arc, b b, with a radius equal to the length of the arms just made. This arc may be divided into degrees, or into convenient units, provided they are equal on both sides of the line a c Get a straight wire which will fit of the line $a\ c$ Get a straight wire which will fit the hole in the butt, and drive it through that hole into the center from which the arc was struck on the base board, using great care to have it perpendicular thereto. This wire, and the pieces b b may be of any convenient height; but that height should be so limited as to avoid danger of their getting bent. It is also needful to have an upright wire, or strip of metal, at c: and one may have the wire a project through the base and form an eye below it, wherefrom a plumb bob may be hung

In using this instrument it may be set up on any convenient support; as a camera tripod, with the line a c aiming at the point corresponding to A in Fig.

1. One arm is swung till the line of the wire, a, and the sight, b, is directed toward the point B,

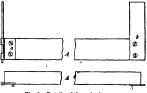


Fig. 3.—Details of the swinging arm

when the other arm may be quickly set off by the aid of the graduations on the arc, to an equal distance on the other side. The rest is the same as previously

Shop Notes

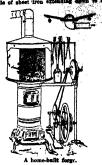
Sawing Thin Bars .- Those who have had the job of cutting thin brass or copper tubing with the hack-saw are acquainted with the difficulty usually encountered as a result of the tendency on the part of the saw to bite into the walls of the thin tubing This difficulty can be easily overcome. An old hack-saw blade, which has outlived its usefulness, is all saw place, which has outlived its usefulness, is all that is necessary, and therefore the method is one that fits in well with shop economy. The teeth of the blade are first ground down with an emery wheel until only very small teeth projections remain.

Cutting Off Steel Shafts.—The following little kink may be appreciated by many machinists who have had more or less trouble when cutting off steel shafts. By simply turning the cutting-off tool upside down, and running the lathe backward, it is possible to aland running the lathe backward, it is possible to ai-most entirel eliminate any digging in of the tool. This method will be found to be far superior to the ordinary method of cutting off stock. Of course it works to better advantage when using a cutting-off tool. It is necessary that the lathe be reversed, or, if the cross-slide permits of the tool being placed on the opposite side of the lathe in the rear, then the reversing is unnecessary.

How to Remove a Wood Screw.—A handy way of removing a wood screw that has stuck, and is so tight that there is danger of twisting off the head, is as follows: Heat a poker or a piece of round iron red hot, and hold it against the screw head for a lit tle while. Wait a few minutes for the screw to cool off, when it will be found that the screw can be moved quite easily with the same sorew driver that just previously would not perform the work. The explanation is simple. The red-hot poker heats the screw, the screw expands, and makes the hole it is in just a bit bigger. The screw then cools down and just a out organ: The serve men cools down and resumes its original size, leaving the hole in the wood a size largar. The writer has given this little kink a fair test is taking serves out of some wash boards that were built in a refrigueator where the

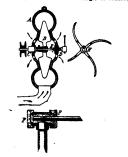


THE torge here time simple way. A be all stove which and reduced the floor space for the 1



shaped casting. Two sliding doors were curve fit the bowl-shaped casting and the sheet iron drum enabling one to open and close the door as desired. The illustration shows the arrangement of amoke pipes for the stove and forge. A sketch at the top shows the tuyere iron which is a small dome-shaped casting with a few holes drilled in the top to permit casting with a few noise grilled in the top to period, the air blast to pass through. The tuyere iron was simply laid on, its own weight keeping it in place. The blower case was made of wood in two halves turned in the lathe. The sectional view marked A

The blower case was made of wood in two halves turned in the lathe. The sectional view marked A shows the shape. The fan was made of metal. In making the pattern, the part marked B was turned in the lathe and sawed out with a fine saw to the pe shown at H. This made all the blades of the same form and shape, a result which would have been difficult of attainment if the fan had been made in separate parts. It was essential that the blades re-volve quite true and close to the case at the V-shaped At C is a hickory bearing inserted in the shell A. The opposite side of the shell has a piece of metal inserted with the thread cut that receives a hickory series marked D forming the opposite bearing of the spindle which is simply a tapered center. This has proved quite durable and has lasted a number of years without renewal. Holes were bored through the case around the bearings to furnish an infic The counter-shaft is simply a smooth shaft held in place by a fine cup-shaped piece F that was turned in the lathe. A thin piece of paper was wrapped around the shaft at G and Babbitt metal was poured into a pipe fitting which formed the hanger or bracket for



Sectional view of the bi

the bearings. The bearings made in this way are quite simple, as the shaft does not used any to prevent side motion. The general erra of balance wheel, pulleys and belting, hans

of balance wheel, pulleys and balting, fange-pedal is quite clearly above, in the speciel.

The following are a few of the pytholiqua in ments: Extreme diameter of blower shell, 845 inches, blower shell, 845 inches, blower shell a figure of blower shell is de-counter-dust % of an inph in diameters; if the state of the second of the se



The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting



- A Tool with Many Uses By Jacques Boyer

FRENCH inventor named Sellier A has devised an apparatus which he calls the Universal because it consti though it occupies little space and weighs only 132 pounds, it comprises a forge, an anvil, a boring machine a vise, a work bench, a grindstone and a

The steel anvil which can be moved along the cast iron base of the machine the vise. The other law is a fixed steel and provided with a tool head and serew 200 000 rounds of government cartridges [Up to that time I had not the least on sulted our greatest h-mists and also

ment was not accepted as being a fact Some said it was altogether others said that the state

working the mechanism it can be im tainly done some very clever work since which comes agined that such an extraordinary state you have come to England and I have charted wood been thinking that I might turn som too good of your cleverness to account for th b n fit of the government We have a er But the little gun was very much in evi us a solution of the problem. At dence and when H R H the Prince of rate come to my office at the Morse Wales had visited my workshop and fired Guards to-morrow morning at else n pre-

from th alle quantities of this couponities by his couponities of the couponities of the couponities and become and be England and have had no t soever in pretaring the trut har sal to be true others asia that the state in of the government we have a ct seever in prejaring the ct of the ments should be taken with a grain of the ments about the state of the seever in prejaring the ct of the is found to be exactly the same. Still when we come to fire on powder in a my gun other members of the royal (leely and I will tell you what the rid family followed and it was not long be for it was considered quite the thing to I was on hand? Precisely at eleven to said the substitute of the Grunan powder our powder precisely at Maxima workshop and fire his o clock I stepped into the generals of yellowing the substitute of the Grunan powder or what Maxima workshop and fire his o clock I stepped into the generals of yellowing the substitute of the Grunan powder or what the s luces high pressures and gives us lovelocities while the (erman powder of the other hand gives low pressures at lingh v locities. We have right tilly on







Bet up for boring

Working with the vise.

Sharpening a tool on the grindstone







The Universal as an anvil.

Cutting pipe on the Universal VIEWS ILLUSTRATING THE VERSATILITY OF THE "UNIVERSAL."

The Universal as an anvil and forgo

other tools This end of the machine also carries a dust proof tool box and a forme, which is simply an iron pan con grindstone The forge can be removed when it is not needed Power is fur nished by a treadle or otherwise The ransmission is devised to give either a low speed for boring etc., or a high speed for grinding. The construction and uses of the Universal machine require no detailed verbal description, as they are clearly illustrated by the accompanying

The Solution of a Riddle

By Sir Hiram Maxim

the winter of 1884-5, when it was nounced in the London newspapers In

This had not been going on long before I received a communication from the War Office stating that a large number of War Office officials intended to pay me a visit on the following day at 11 o clock Of course I was on hand and ready Among the high officials were Lord Wolseley General Sir Andrew Clark Surveyor General of Fortifications for the British Empire and many others I fired the gun myself and allowed the officers to fire everyone was amazed at the rapidity with which a single barrel deed it is a revelation no one would have believed it to be possible and all agreed that it would work a revolution in military tactics. I was very much skill as a mechanician

In about an hour they had all left ex witcan engineer having a cept one officer General Sir Andrew Hatton Garden had in Clark who said 'Mr Maxim I wish

possibly be

as follows which I quote as near as I attempted a solutio; f th mystery can remember it I suppose you are The German makers den at I a very high aware that the Germans have recently price for the serit and we are just in owagat out what they call a slow burn cally at the 1 tit of puying the large ling cocos powder for use with artillery aum of £ 1000 for the arrest which We have experimented with this new seems to be absent when the powder and find it to be ween the state of £ 1000 for the arrest which powder and find it to be ween the state of powder and find it to be very good in orsilitation that the deed. It is an excellent powder it gives be mical constituents high velocities with phenomenally low pressures. The raison why this powder as we have absolutely fall d t find out its not black is because the charcoal is what the sceret is after in nihe of set it. not carbonized at a very high tempers and experiment I hav thought that I ture as is the case with ordinary char haps you as an Amerian might find a There is still a little hydrogen solution and save us the 4.3) a it therefore its brown color It To this I replied Sin A ir w. I left in it therefore its brown color and powder. First you dissolve out the later with water and then dissolve the sulphur which will leave the charcoal We have found nothing in the control of is an extremely easy matter to analyze thank you for the omplin that y ongratulated on my success and my gun powder First you dissolve out the sulphur whith will leave the charcoal lishmen In select split levelife we have found nothing in this powder schence I am noth it is t george except charcoal inter and sulphur if the distinguished jits s whim you

clamp for the attachment of drills and | were used in showing the gun to visitors | ception as to what the mystery could | many other scientific m n of the highest possibly be order and still we ar as mu h in the Sir Andrew of ened proceedings about dark to-day as we wer while we first of this Cerman

that bug s) illy ferifeal season warrows name in-[clark who said 'zer maxim I wish except charcont inter and sulphur II the distinguished it is a whun your at least in the property of the control of the said I am I risk man I risk man I others and they all give us exactly the self when the said I am I risk man I others and they all give us exactly the self when the said I am I risk man I others and they all give us exactly the self when the said I am I risk man I others and they all give us exactly the self when the said I am I risk man I others and they all give us exactly the self when the said I am I risk man I others and they all give us exactly the self when the said I am I risk man I others and they all give us exactly the self when the said I am I risk man I others and they all give us exactly the self of the said I I man I risk man I wish the said I I man I risk man I wish the said I I man I risk man I wish the said I I man I risk man I wish the said I I man I risk man I wish the said I I man I risk man I wish the said I I man I risk man I wish the said I I man I risk man I wish the said I I man I risk man I wish the said I man I wish the said I I man I risk man I wish the said I I was the said I I wish the said I I was the said I I wish the said I I was the said permission, come to this office at the same hour, when I shall be able to ex-plain to you what the difference is between the two kinds of powder in lan-guage that you cannot fail to under-stand. in fact, I will give you a demonstration '

Sir Andrew was amazed; he thought it was too good to be true 1 then pointed to two hats on the table and said "If I come into this room and you tell me that there is an orange under one of those two hats, and I pick up one of them and fail to find the orange, I then draw a logical conclusion, the orange is under the other hat. You have already told me what the secret is not, and to-morrow I will tell you what it is" Sir Andrew then gave me a block each of the German and English powders. I took them to my workshop, and after polishing the surfaces of the two blocks, I first examined with my microscope the English and found, just as I had expected, that the highest power that could possibly be used on an opaque body showed nothing but a homogeneous smooth surface, evidently the constituents were very finely ground and intimately mixed When I came to examine the German powder, this, too, was exactly as I had expected-the sulphur and the charcoal were very finely ground and intimately mixed, but the niter was granular I measured the grains and found that the largest had a diameter of 0 005 inch and that the smallest ap peared to have a diameter of 0 001 of an inch This, of course, was a complete solution of the mystery, and the next morning promptly at eleven o'clock I again visited Sir Andrew's office, taking microscope and the powder with me He saw the point at once and said he was simply amazed that their scientific men had not been able to find out what the difference was. It was only too evident that they had relied altogether on chemistry, when, as a matter of fact, it was not a question of chemistry at all

Of course be congratulated me very or course he congrutuated me very strongly and had much to say about the common sense of Americans A few days later I visited a powder factory and made about fifty different grades of powder, all the way from very slow burning up to one of very great rapidity of burn-The process of making the various kinds was extremely simple I first weighed out the charcoal and sulphus and kept them in the mill for about three hours. , when they were very finely id and thoroughly mixed. I then added the piter, which was already in a fine granular condition, and when it had been in the mill for ten minutes I took out a specimen—this was my slow burning powder I took out other specimens, at first every two minutes, then every two and a half minutes, then every three minutes, and so on Of course the last would be the quickest burning powder. I took these specimens back to London ith me and arranged a lot of V-shaped channels about eight feet long. These I placed side by side and filled the first one with the slowest powder, then the channel on the opposite side with the quickest powder, and between these I had the powders arranged in their order of rapidity of burning, and all the ende were connected together by some very fine and quick powder. I then invited Sir Andrew and his assistants to witness my experiments I touched off the quick nels in such a manner that the burning ends of the powder in the grooves were practically in a diagonal line. By the time that the fastest burning powder had been completely consumed, the slowes burning had not been consumed an inch This demonstration proved beyond all possibility of dispute that powders of all degrees of rapidity of burning could be made by simply varying the size of the grains of niter.

This was my first experience in explosives, but I continued experimenting for sears and took out a large number

Statistical Data in the Annual Report of the Commissioner of Patents.

AST week we noted some of the sali-Lent points in the main body of the Commissioner's report. We have now be-fore us tabulations and statements in figures on the progress of the Patent Of-fice during the past year, and since the beginning of the present series of patent issues in 1836

This portion of the report also shows a number of interesting facts, from which some of the chief are selected for reproduction here.

The balance sheet for the past year shows a surplus of \$19,824 75. This makes the total accumulated surplus up to December 31st, 1910, \$6,998,227 64

The total number of applications for patents (including designs) during the year was 64,448 The total number of year was 64,448 The total number of issues was 35,807, to which may be added 11,336 applications allowed, but awaiting payment of the final fee.

There were also 7,442 cases forfeited

for non-payment of that fee. Reissues numbered 123

An interesting table is given, show-ing the inventive activity of the several Itates of the Union. Connecticut stands first, with one patent issued to every 1,126 inhabitants. It is somewhat sur-prising, perhaps, to find the District of Columbia second on the list, with one issue to every 1,329 inhabitants Then come in order California, Massachusetts, New Jersey, Colorado, Illinois, and occupying the eighth place, New York, with one patent issued to every 1,841 inhabitants

The participation of foreign countries in invention protected by United States tents is shown in another instructive table The total number of issues to citizens of the leading countries was as

tollows.				
Germany				1,0
England				8
Canada .				5
France				3
Austria-Hungary				1
Sweden				1

The order is somewhat different when we come to consider the total number of patents secured by the several countries themselves. To the end of 1910 the fig-ures are as follows:

0. CD MIC 00 10		
Total foreign	countries	 2,138,09
United States		 990,13
France .		 440,89
Great Britain		 425,37
Germany .		 248,10
Belgium .		 237,50
Conedo		100 40

The growth of the business of the Patent Office is brought out by a com-parison of the figures for the years ending respectively December 31st, 1899, and December 31st, 1910.

The increase thus shown is as follows

								P	T cet
Receipts					٠.		 		52.
Expendit	ures		<i>.</i>				 		65.
Applicati	ons	and	cave	ats	fil	ed	 		59.
Patents,	desi	gns,	etc.,	gra	nt	ed.	 		46.
Number*	of e	mpl	оусев	·			 		40.

It will be noted that the number of employees has not been increased in pro-portion with the increase in business

On the other hand, the standard of the examining corps has been raised by the increased stringency of the civil service examination for appointment on that staff, and by the additional inducements in point of salary offered to well-qualified men to enter and remain in the service. The work of the classification division also should result in an increased efficiency, and this may have to on taken into account in considering the growth of the staff, although presumably the full benefit of the work of this divi-

MATERIAL SERVICES SERVICES

The weekly Index of Patents issued by the U States Patent Office will be found in the Sois American Supplement.

Of Interest to Parmers

Of Instructs to Farmers.

BROOM COMP FRESS.—J. J. Fauckers,
Wichits. Kan. The object of this invention is to provide a press which will be efficient for its purpose, practically devoid of danger to the operator or press from caveless handling, and which will stable the basis to be specifly compared to the second of the pressure is provided for automatically restained the door when the basis is compressed.

**NAT DEPARTMENT DEPORTMENT OF THE PROPERTY OF THE P

the door when the bate is compressed.

HAY RETAINING DEVICE FOR HAY

RYACKERS.—J. O. MCCARRAY. Deaver, Colo.

The apparents consists of a sprise of parallel
texth rigidly attached to a cross har consultexth rigidly attached to a cross har consulstate of the consultation of the consultation of the
adapted to slide on the ground. All or several
of the texth are provided near the from free
adapted to slide on the ground. All or several
of the texth are provided near the from free
adapted to slide on the ground. All or several
of which a prived spring-private-of finger
which is adapted to take into the hay and
hold it on the roth of the stacker frame
while the latter is being operated for dumping the hay on the stack.

Of General Interest.

GAFF—W. Walkink, Desigon, Twass.

This invention has reference more particularly to a device which comprises relatively movible jaws for evising the fish or animal, and adapted to be set in open positions, and measured in the same when the jaws are open, the jaws when set holding the means inoperative, where we have not been proported to the property of the

to render the closing means operative.

KNOCKDOWN SHOW CASE,—L. N. Lavissours, New York, N. Y. This case is designed
for use in atomics and other places for containing handkerchiefs and other merchandise,
wantings, the case being simple and arranged
to permit convenient assembling of the parts
or their disassembling to allow packing the
same into a small bundle for transportation
or storage.

table The total number of Issues to or storage.

Germany 1,085
England 884
France 315
Sweden 315
The schausts the list of those when the schausts the list of these whose contributions runs to three blazers in the whose contributions runs to three blazers in the whose contributions runs to three blazers is somewhat different when ROWPHERN MATTERSE.—C C. Cooking.

REVERIBLE (AGR.—O. Everses, Montreal, Canada This gape is one more particularly canada for auxiliar purposes, as in determining provided with a torsion spring, and indicating means controlled by the spread of a beat or a current Use is spring, and indicating means controlled by the spring, and indicating means controlled by the spring. The present investment of the spread of which is indicated by indicating means the spread of which is indicated by indicating means the spread of which is indicated by indicating means the spread of which is indicated by indicating means the spread of which is indicated by indicating means the spread of th

HEVETMENT MATTERSH.—C C. CORDER, Monuphis, Tena. The present invertion prevides inesum for reinforcing and strengthening the matters in such manner as dyagriceved the contexts mass, tagether with means for facilitating the unrolling of a matters when wound in roll form and also means for anchoring a reventment matters on a bank to exercise the context of a river in its use of the matters, and a river in its use of the matters, and the product of a river in its use of the matters. FOUNTAIN PEN—M. S. OLAEN, HERVEY, N. D. This founties pen has a convenient

FOUNTAIN PEN.—M. S. OLEEN, Harvey, N. D. This fountain pen has a convenient and simple means for filling in a rapid man-ner. It is absolutely non-leakable when car ried in the pecket, and the flow of ink may be readily started. The flow of ink adjustable to suit the requirements of the

Mandware and Tools,
REAL FOR PAUCHTS.—C. C. RICKE, St.
Joseph. Mo. This invention is for use in preventing unauthorised persons from tapping a
barrel or key while in transit. Use is made
of a seal or lock overing, the faunce entrance
opening and having means for holding the
scal against urining in the faunce, and mease
for preventing the seal from being lifted out
of the faunce after once being placed in posi-

hold Utiliti

Messashold VillMes.
LIQUID FUEL STOYE OR HEATER—O.
P Worsy, Bloomelis, Ohio The object here is to produce a bacter for liquid feel such as coal oil, sicohol, and similar hydrocarbon, which will be pertable, and which can be readily adapted to throw the heat developed immediately into the room in which the heater is located, or arranged to distribute the heater is located, or arranged to distribute the heat into the rooms or spartnesses.

heat into the rooms or spartnesses.

(ARRAGE (CLOSET.—CONNIGIA B. ROENNNON, New York, N. Y. In this case the invention has reterence to gardness closests, and
it has for its object to provide one with
means by which a pints, normally disposed in
a reveptacte, may be moved forwardly by the
opening of the receptacte door, as that a garleace pall, disposed on a plate, is accessible.

the full benefit of the work of this divi-sion will not be felt for some time to come.

LEGAL NOTICES

PATERI

ontions. To

**Atomics secured.

A Free Opinion as to the probable sility of an invention will be readily given results of the device in question of the device in question in the device in the de All All Out

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THE DRAF HEAR lostently and clearly with the Acousticom. You must been before your purchase, Special instruments withversally said in Cauriches and Theories Bookie Tree. General Acoustic Co., EN Beautor: Street, Jamales, New York City LEARN TO FLY, \$1,00,000 IN PRIESS.—Correspondence output in averton. Discretizing Extension Principles.

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Inquiry No. 9217. Wanted, the names and ad-dresses of maculacturers of machinery for shelling al-Inquiry No. 9318 .- Wanted, the names and ad-dresses of manufacturers of outsite for salving almosts Inquiry No. \$222.-Wanted, to buy me Inquiry No. 9294. - Wanted, to buy a motor de Inquiry No. 9335, - Wanted, a concern able to Inquiry No. 9336. Wanted, to buy a much making flat-sided popours cakes. Inquiry No. 9337.-Wanted, a power-driven for cutting down pine trees twenty inches in diam Inquiry No. 9988,-Wanted, to buy tabric tu Inentry No. 9338. Wanted, address actorers of an alloy called Duraluminum Inquiry No. 9930. Wanted to buy a plant for

faculty No. 9481, -Wenred, addresses of or or water falls buring a four-foot fall and abwards. inquiry No. \$28%. - Wested, addresses of me facturers of eligines that can be run with winds on. Inquiry No. 11988. Wasted, evolute or teles de fragely to sell trop to the transfer of the sell trape and Insultry No. 2022 .- Wanted manner and addresses of machinery and applicates for

Jew Line, Period and and a

Notes and Queries



rupturing the oil vessels of citrus fruits. Its construction will be seen by the annexed en-graving. Short spines serve to rupture the oil vessels, and a shallow trough serves to carry away the oil gathered.

(1837s) C. H. D. asks: Will you kindly still nef it there is any difference between sun and atsadard time in Washington, h. C., or if they are both the same time? If there is a difference, how many minutes? A. Restern standard time is plat of the forth meridian standard time is plat of the forth meridian of the standard time in the plat of the form of the standard time. The city of Washington, D. C., is 5 botten, 8 industry, and alout II sevends west of threshold time. The city of Washington, Dr. C. is 5 botten, 8 industry. A many control of the standard time and Washington time. Mastern standard time and Washington time.

(13379) C. J. J. saks: Can you give me spine idea of how many pounds a log 12 inches by 12 inches. 25 feet long, will hold up in fresh water afnort 1. A. The timber contains 25 cubic feet, should weight 1,000 pounds, and displace as equal weight of log would displace 25 cubic feet of water, weighing 1,102 pounds, on that you could support a weight of 502 pounds on top of the log. Naturally the log would assuport a weight of 502 pounds on top of the log. Naturally the log would assuport a weight of 502 pounds and you water and increase in weight, and you could not loud the log with that it was fully could not support 500 pounds, as calculated.

(1286) A. W. F. writes: A certain little senational magazine has a piece about the "dark day." May 16ht, 176, and makes a question (*) from Reverbal the attrono harden of the senation of the (12380) A. W. F. writes: A certain

(12851) T. F. P. says: Will you kindly toll as what metal, or combination of netals, to see a second of the combination of conduction to 0000018; then of the case of conduction to 0000018; then of the case of the combination of conduction to 0000018; then of the case of the combination of conduction to 0000018; then of the case of the combination of the (12881) T. F. P. says: Will you kindly

(12377) C. H. G. says: What is an out and got a different answer I worked it as fellows: Mameter of the belt before length-

-- = 42,016,940.46645 feet The dismeter of the belt lengthened 18 feet is 132,000,018

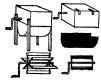
sprinting the oil vessels of citrus fruits. Its present of the control of the con

(12384) A. J M. asks for a table of decimal equivalents A Table of Decimal Equivalents.—Of 8ths, 16ths, 32ds and 64ths of

Inch .		
1 - CAMADA	### 86/115 ### 86/115	### 971576 ## 9675 ## 708185 ## 71816 #
N == 1886195	65025	= 984375

(19385) H. H. asks. We have a radio

(12386) A C L asks how to make a sleve. A The construction of a home-made sleve will be residily understood by reference to the engraving. Sheet from or the and wood may be used. Wire screening of the proper flueness should be employed. The salting arms may be



mere is the described electrical which will not an early out with to do that (19588) C. S. S. says: If convenient, it is considered to the construction of the constru

1

When

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Longer Piers for the Port of

New York

that the city of New York seeks no ex n which will be unfair to New Jer sey interests, and asks that the estab-lishment of the pierhead lines on both sides of the river shall now be given con

As regards the third objection, I would espectfully submit the following points:

1. The fairway opposite the Chelsea

district is now 2,750 feet wide between pierhead lines. The extension asked for will reduce this to 2,650 feet, a width greatly in excess of that of the fairway at other important ports; thus, at Ant-werp abreast the port the river is 2,000 feet wide, and in some turns of the river only 1,000; at Hamburg the river is 1,-200 feet wide, and at Rotterdam 1,200; at Liverpool, 2,000 to 2,400; the Thames at the Tilbury Docks is approximately 1,600 feet wide, and at London, in some parts of the London docks, where large steamers continually go, the width of the river is reduced to 600 feet. It is also to be noted that the Hudson fairway is nearly straight in comparison with the tortuous channels existing at many of the ports noted.

2. Sailing vessels, river boats and Salling vessels, river locats and lighters have almost disappeared from the harbor waters. Traffic is now gener-ally moved under steam, and is consequently under better control than for

merly
3. Twin scrow steamers of modern construction can turn and maneuver is much shorter distances than heretofore. 4. If need be, the movement of traf-fic can be placed under greater police restriction that at present; although this

does not now seem necessary. 5 The Ambrose channel has been dug at great expense by the Federal authori-ties and should be availed of to bring vessels of a length proportionate to their draught to Manhattan.

The Panama Canal locks are being constructed for vessels 1,000 feet in length, and accommodations for this class vessels should be provided.

7 In the Chelsea district it will be impracticable to secure greater pier lengths by excavation inshore on account of the prohibitive cost of such undertak ing, and the fact that a marginal elevated freight railway is being planned the alignment of which will be preju diced by the sharp turns made necessary by such a radical change in the city street plan. Again, the city has just finished the construction of the new their kind in the world, at a cost of about \$24,000,000, and any rearrangement at this time will be most unfortu-

nate. 8. The steamship companies occupy ing the Chelses piers have leased then for long periods of time, and the city cannot relieve them from these engage nents without serious disarrangemen to its finances, since it is depending upon the capitalization value of revenues de-rived from leases for additional waterfront improvements

would venture the suggestion subject to the opinion of the New Jersey authorities, that an extension of the pier-head line of Castle Point, opposite the Chelsea district, is not urgent or desirable, since it is the jutting point of the New Jersey shore and better opportuni-ties for extension exist both above and below that point.

10 A slight turn in the river at this point tends to deflect the lines of traffic both up and down stream toward the New Jersey and away from the Manhat

/11. The Department of Docks has no pared and will soon submit its report for a better system of railroad terminals for the west side of Manhattan. In a gen-

aded and unloaded at terminals on the east side of the marginal way, thus restoring the waterfront to marine com s. If the policy recommended is be adopted, it will ultimately be possible to build long piers for long ships at many points, which will be to the advantage of the port's commerce. The greatest sea the greatest ships to their and its great est advantage.

I submit herewith:

(a) Cross section of the river opposite the Chelses piers as modified by inshore excavations on the Manhattan side (b) Sketch showing additional length of piers in this vincity.

(c) General plan of proposed pier-head line extension along the west side of Manhattan from the Battery to 99th Street.

Sketch of Cunard and White Star (d) plers in the Chelsea district, together with models of steamers "Baltic," "Olym-pic," and of proposed new Cunard ship. In conclusion, I will again state that New York city submits no partisan ples and desires to reach a decision which shall be fair for New Jersey as for New York interests, and which shall not prejulice the future utility of its harbor.

Creating New Kinds of Animals and Plants

from the Little Club was used on stig-mas from the Valley. The right half of the picture shows the results when pol-len was used from Valley on the stigmas of the Little Club. In each case the re-sults are seen to be the same. The three short heads shown at the extreme left of the picture are three first generation hybrids. It is seen that they are all alike and very much like the Little Club. To the right of each of these Ciub. To the right or each of these three heads are seen the six types, which could be distinguished by inspection, produced by each of these first genera-tion hybrids. One type is seen to be and bearded; another ardless; another of intermediate length and bearded; a fourth of intermediate length without beards; the fifth bearded Club and the sixth beardless Club The wo intermediate lengths are hybrids between long and short heads. The same types are seen to appear in every case in the second generation. For instance in the cross between Valley and Club there were some plants with lax bearded heads, other plants had lax beardless heads, others bearded Club beardiess heads, others bearded Club heads, while still others had beardiess Club heads. It was found later that some of all these types were winter wheat, some spring wheat, and some hybrid between winter and spring wheat. In every one of the crosses made, the combination of good characters sought for actually occurred, and several new varieties of wheat were produced which combined the winter hardiness of the winter wheats with the stiff straw and the tightly closed chaff of the spring wheat. In due time the pure types of the kind desired were selected out of these hybrids, tested for yielding power, and finally, in the fall of 1907, distributed to the farmers of eastern Washington These hardy hybrid wheats are grown very generally in that region and are producing yields very much larger than the old Little Club produced. Not only that, but the quality of the grain is better, and the hybrid wheats sell for

two or three cents a bushel more than the old Club wheat.

I have already referred to the fact I have already referred to the fact that a new breed of cattle has been pro-duced by the deliberate application or Mendol's law of recombination. Fig. 5 is a picture of a very fine animal pro-duced in this way. Originally the Polled Durham was crossed with the are west such manimation. In a gen-Poiled Direham was crossed with the creat way this report recommend that the Hereford. After several generations present system of delly storage of ear pure polled exitie were produced that had fout terminals along the river front be the red color and the white face of the so changed that railroad cars shall be Hereford dreed, and a registry essential.









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YPEWRITERS MAN Visible Writers ... Officers, Branchesses, Smiths, Stanford All Variables SERVE To The Performance Servers of the Se





tion-in fact, two of then tarted for registering Poiled Herefords I have already stated that it is not always possible, by inspection, to distinguish between an animal which is a pure poll and one which is a hybrid be-tween the polled and the horned. Frequently the hybrids have no sign of a But there is a way of distinguish

ing these hybrids from pure polls, esp ally in the case of the males. It is as follows: Breed the male to a dozen horned cows. If he is hybrid, the chances are that he will transmit the horns to half his offspring. These, receiving horns from the dam also, will be pure horned animals. If, however, the animal is pure polled, he will transmit the poll character to all his progeny, but the hybrid between the polled and these caives will have perfect horns, none of these caives will have perfect horns, no matter what his dam is. But since it is an even chance whether a hybrid of this kind win transmit horns or the poll character to a given offspring, it is possible that a hybrid might get twelve polled calves from twelve horned cows. The chance, however, that this will ocour is only one in more than four thou sand cases. Hence a breeder who has thus tested a young bull is safe in guar anteeing that none of his calves have perfect horns, no matter what the dam may be. He will have to make good this guaranteed once in 4.096 times ers of Polled Herefords now frequently test young bulls in the manner above described, then sell them at high prices under a guarantee that all their calves will be polls, or at least have only

aratively easy matter produce any desired breed of animals or any desired variety of plants when th various characters desired can be found be cross bred. Application of these principles in producing new breeds varieties have thus far not been very varieties have the principles are new, but they are being used now more largely than in the past, and will undoubtedly play an important part in the improvements of farm crops and farm animals in the future. In fact, the same principles can be applied in improving the human race, and they are now being applied in a rough way in several States.

VIGOR OF HYBRIDS.

Another important principle which is frequently made use of by farmers is the fact that generally speaking hybrids are more vigorous than pure-bred plants are more vigorous taan pure-ore plants or animals. Fig. 2 is a photograph of some steers which are hybrids between Short Horns and Herefords. They have characteristics white face of the Hereford, but the spots of red in the face show the hybrid origin. Mr. Wal-lace Huidekoper, of North Dakota, who furniahed this photograph, produces many such hybrids for feeding purpos and states that they feed better and make better beef animals than the pur This principle is frequently ap plied by hog breeders to produce feeders; but on account of the law of recombination of characters, these hybrid animals do not reproduce true to type hence are not good for breedi

Our knowledge of the law of re ation enables us to get rid of undesirable characters, which occasionally crop out in breeds of animals. For instance, in all of the polled (that is, hornless) breeds occasionally horned individuals We know now that this can are born. We know now that this can becur only when both of the parents of the horned calf are hybrid with refer-ence to horns. This shows that there is still, in all these breeds, a small perin them. When two such animals are mind the chance are that one-fourth of the calves will be hereed. Exewing the

cause of the annearance of horns in these breeds, we are in position to avoid them by eliminating both the sire and the dam of such calves whenever they occur. In this way the proportion of horned calves born in the polled breeds is gradually decreasing, until now they are very rar adeed in some breeds.

In all black breeds of cattle the occasionally red calves born. This is due to the fact that there is, in such breeds, ill percentage of animals that are hybrid between red and black. When these are mated, one-fourth of the calves are red. The undesirable red can be eliminated from the breed only by destroying both the sire and the dam of every red calf born.

Dr. Pearl, of the Maine Experiment Station, has recently shown that high egg-laying capacity in bens is trans mitted as a Mendelian character. is a matter of very great importance, and will undoubtedly result in great improvement in all of our breeds of chickens

Another interesting application of Mendelian principles is seen in the cross between Brahmin cattle and our common cattle which is being made on a large scale in our Southern States, especially Texas. Fig. 1 is the photograph of a Brahmin bull owned by the Georgia Experiment Station. The most important characteristic of these cattl is the fact that the Texas fever tick does not molest them. This immunity from the tick, and consequently from Texas fever, is a dominant character, so that the hybrids between Brahmin cattle and our common cattle are immune to Texas fever

Mr. A. P. Borden, who is one the prominent breeders of these hybrid attle, informs the writer that because of this immunity from ticks the calves of this breed are much larger at weaning time than our ordinary calves, and sell regularly for fifty per cent more on count of their size and thrift Mr. Bor den recently imported from India a large number of these Brahmin cattle, and sev eral breeders are now engaged in dis tributing this blood among southers

Fig. 7 illustrates a mistake that breeders of animals sometimes make.
This shows a pig of the Hampshire breed. which has a white stripe over its sould-ers. This white stripe is an exceedinly variable character, and it is exceedingly difficult to breed these pigs true to type This white marking is a character which has no economic value, and in order to breed it pure it is necessary som to use animals for breeding purpose that are not of good quality.

Fig. 4 shows a similar mistake with a breed of cattle. It will be noticed that this animal has a white stripe over the hips and another just behind the should A few breeders insist that their tle shall have these white stripes. They are of no economic value, and the at tempt to establish such a character is rtain to react on the economic value of the breed.

Fig. 9 shows a sample of what is known as hogget wool. This sample was taken from one of two fleeces found in a large quantity of wool bought by a country buyer in Michigan It sold for ninety cents a pound, while the other coss sold for about twenty cents. The is the characteristic which makes it so valuable. We have not yet been able to locate the herd of sheep from which this mple came. If we could locate it, and the waviness of the wool should prove to be a Mendelian character, it would be a very easy matter to spread it over any or all the breeds of sheep in this coun-

which must be applied to do this.

While Mendellan principles are new and have therefore not yet been widely applied, it is easily seen that there is room for enormous improvement in plants and animals by means of these scientific principles.

Waterman's Ideal Fountain Pen

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cork.

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words is the capacity of this pen after each filling. Two weeks' writ-A ing with a sure and perfectly safe pen without simple pen dip, skip, blot which is easi or blemish.

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Coment on the Farm

(Continued from page 387.) and the roof are all made of concrete. In making a mushroom cellar, it should be built at least two-thirds below the level of the ground, in order to give the best results.

From a commercial standpoint, the modern farmer has found that it pays to have an automobile. Owing to the lisbility of fire, the old wooden bars is a boor place to store it. Concrete suggests itself as the most feasible material of which to build the garage, as saide from its being fireproof, it will not come saturated with gaseline and oil, and it is easily kept clean. The garage can be built of concrete blocks made on the farm with either as block machine or from home-made wooden molds. Built in this way, the initial cost will be low, and the maintenance charges on such a building will practically be nothing.

The floor as well as the side walls and roof should be of concrete, and a good drain should be provided in the center of the floor to carry away the wash

Concrete is especially advantageous of the breading of structures where perfect cleanliness is desired, such as dairy buildings. Experienced dairymen state spart in the soil. Stone uses 2-inch such at the material of which the bearn is pipe with 3/16 to 54-inch perforations made is of vital importance; for as a rule, this is the breading place of germs. By using concrete this question is to a large measure solved, because a building is constructed ofters no lodgment for the breading of germs.

If the floors, stalls, troughs, etc., are also made of concrete, perfect hygienic conditions can be obtained, and the probability of securing a good germ-proof milk is made much greater. Thus the farmer who is equipped with concrete dairy buildings is far in advance of his neighbor who still helds to his old-fashioned wooden structures.

Concrete is also largely used in tree surgery. Many a good tree has been saved by filling with concrete the large cavities which have developed in its trunk, due to disease and rot. If the cavities are so large that they have weakened the trunk of the tree, steel reinforcing should be incorporated into the patch, so as to hold it better in place and to give it strength. There are numerous other small articles about the farm for which concrete can be used, such as chimmer tops or caps, hothouse frames, and well curbs. It is particularly adapted to the lister use, as it prevents the accumulation of surface water and is result kent (clean.

From the instances cited above, one will see that concrete, when properly used, is a most adaptable material But to obtain the best results, care and judgment must be exercised in its handling.

It might be well to caution the reader on closing that in building any structures, or parts of structures, the failure of which would endanger life, such as floors, rofe, side walls, large tanks, etc. it would be well to consult an engineer for information as to the requisite thickness and the proper size and location of the reinforcing steel.

New Science of the Soil

('outsand from page 38).

of the air, render the nitrogen of the soil more readily available by nitrification, and increase the availability of the
insoluble phosphates and potsals compounds of the soil. The activities of
these organisms may be controlled to a
large extent by the methods employed in
fartilising and treating the soil. (See also article on "The Science of Fertilising the Soil.)

Many years ago it was observed that treatment of vineyard soils with earbon bisulphid to destroy phyliosers, an insect preving upon the roots of the vines, produced beneficial results which could not be wholly attributed to the destruction of the judgitioners, if, in Stone, of

the Manachusetts This column to the Manachusetts This column to the Manachusetts while against the manachusetts while apparently a creased the actual tertility of the solis, in addition to destroying certain consular of plants harbored by the solis. Siming and Hutchinnon, of the Rothameted Experiment Station, found that seisming and treatment with velacitic antisoption like carbon blutphid or tokuses only partially sterilized the soli, killing certain protoces and sauceb within feed upon the beneficial ammonia-producing bacteris, but not entirely destroying the latter, which thus freed from the ornanism which hold them in cheek grow rapidly and soon become more numerous than before, increasing the supply of ammonia, and in consequence the fertility of the soil

TO PERSON LATE OF CHARGOST PURNARIOS SERVICES

As a result of such investigations as these, soil sanitation is coming to have a recognized place in agricultural pracsterilizing, or partially sterilizing, soils are now in use for small scale operations. The Vermont Experiment Station sterin place by forcing steam under 40 to 60 pounds pressure through 8-inch drain tile placed 10 inches deep and 16 inches apart in the soil. Stone uses 2-inch gas made up 7 to 10 inches apart, in frames of any desired width and length Some of the frames are made in sections, so that they may be extended as desired. (See Fig 2) "These frames are provided with headers h, placed trans-versely, which are pipes of larger diameter containing perforations, and ninples a are inserted at intervals which readily fit into the extension pipes s. In some instances the headers are placeach end, thus forming with the extension pipes a frame composed of a series of rectangles (Fig. 2A). In this form a complete circulation of the steam can take place. In others the headers are in the middle and the extension pipes lead off into opposite directions (Fig. 2B). In the latter case the ends of the ex-tension pipes are plugged with wood to, and a complete circulation of steam doe not occur. The material most frequently used is iron pipe .

The method generally adopted by lettuce growers in heating their soils is to place the apparatus on the surface of the If the bed is 2 feet wide, then it will be most convenient to have the heating appliance about 10 feet wide and 20 to 30 feet long. This is placed midway between the edges of the bed, and the soil to the depth of one foot is dug out on either side of the appliance and on top of it. This covers the heating apparatus to a depth of one foot. The steam is now turned on and the soil heated After sufficient steaming has taken place, the pipes can be pulled out and set up ready for the next treatment. The soil previously 3.) treated should be covered up with son old canvas, if available, or, in fact, with anything that will retain the heat, allowed to stand some hours, after which the top portion is shoveled back to where taken from. Not only is the one foot of top soil heated by this method but the soil under which the appera rests is equally well done, provided too much haste is not made in removing the treated soil.

A uniform temperature of semewhat over 180 deg. F. maintained for one and a half to two hours is considered sufficient.

A soil starilizer used by the United States Department of Agellocities and the Connection State Supersenses that the Connection State Supersenses Station in steaming telescop plant hede is shown in Fig. 4, 16-densities consultailly of a re-enforced 18-gase galvanised from pan. 6 × 10 foct againty and 4 inches doop, with a steam takes connection with an earlier than the control of the San State Connection with an earlier than the control of the San State Connection with an earlier than the control of the San State Connection with an earlier than the control of the San State Connection with an earlier than the control of the San State Connection of the San State Conne

is tuened in for thirty minutes.

THE REPORT OF THE PROPERTY OF THE

is assessed as our there; misures.

Modern selector has thus shown that
the self swarms with living organisms,
some heightid, seems barmful; and it has the of controlling the ranteme, and in a museure, determining the kinds that shall prevail. On a small sonia, starilisation as described above may be used; on a large scale it will be found that beneficial bacterial activity is best promoted by the conditions which good farmer aims to secure, viz. good tilth, deep cultivation to secur-thorough seration, an abundant but no ssive amount of water, and ade quate supplies of humus, lime, and phos

The Weather Bureau

(Consisted from page 176.)
This class of instruments in which the electric discharges in the atmosphere are registered at great distances by wireless telegraphy has interesting possibilities; as yet, they are possit

The long and short of it is that Farmer A must continue, for some time to come, to be at the mercy of the occasional unheraided local shower, and must console himself with the reflection that the more serious visitations of the elements cold wave, the blissard, the severe cyclo--will rarely come his way without due notice in advance from the fore-

WHERE THE FORECAST SUCCEEDS.

Let us, however, turn to another part of the country, where a first cousin of Farmer A, one X, is engaged in drying fruit, and is making a tidy fortune out of it, thanks to a sunny clime and the Weather Bureau. X lives in California; somewhere in the great valleys of the interior. The summers are very hot and almost rainless. The fruit-drying season comprises the latter half of the summer the early autumn. Generally speak ing, the climate is ideal for this industry shewer meant ruin. That was before the scattered handful of Weather Bureau men assigned to duty in that State turned their special attention to the dusi task of making accurate forecasts of rain and giving them effective distribution ver needed.

To-day every fruit grower within reach of the buerau's forecasts depends upon them implicitly. The burden of respon sibility resting upon the forecaster is enormous. He must not, on the one hand, permit a shower to take the grow ers by surprise, and, on the other, he must not issue a false alarm, which would put them to needless expense in taking measures to protect the fruit. The work of forecasting for the raisin makers as this was the earliest application of ecial rain forecasting for fruit growers. Fig. 2 will perhaps serve to convey-on the principle of ex pede Herculessome faint idea of the importance of this particular work. Raisin making is, however, only a part of California's vast industry of drying fruit. Apricots, for example, were dried last year to the extent ample, were dried last year to the extent of about 15,000 tons. Of dried peaches there were 25,000 tons. There were near ly 4,000 tons of figs, black and white, 40, 600 tons of prunes, and a few thousand tons of apples and pears. From July to the end of October the curing of fruit ing on in one part or another of the State; and during this whole period a re of men bear the burden of watching the weather, alert for the earliest sign of the coming shower. Upon the District its most beavily; but without the faithful and intelligent co-operation of every ru ann, nitelligent cooperation of every lean serving under him, he could not make his viorit the splundid secons that It is. In the beneasting of summer rains in (Shifernite alone the Weather Bureau leasting the thinteener; renders quick pro-pers for the hallon and a half delicate of the country beautiful and the service these

our friend X expresses his opinion of the Bureau on paper for the enlightenm of Farmer A.

THE FROST CAMPAIGN.

To take a further illustration from California, let us see whether the little squad of weather watchers, after the nerve-racking strain of the summer camsaign against rain, are able to take things easy during the winter and re-cuperate. Far from it. The dried fruit is safely garnered; Jupiter Pluvius has expended his ammunition in vain. But now another formidable foe enters the field—Jack Frost. At this point I cannot do better than quote from my friend Prof. Alexander McAdie—the captain of the Weather Bureau's forces in the far West-a man whose services to the na ion are so well known that it would be an impertinence to dwell upon them here. Prof. McAdle says in a recent letter to the author:

ssing to the work in connection with the oranges and lemons, especially in guarding them against the frosts of uary and February, it may be said without exaggeration that the San Francisco office of the Weather Bureau seved to the citrus fruit growers of California more money within the last five years than the annual appropriation for the entire Bureau during a period of twenty years; and we consider that our work is only a hundredth part of the work that is accomplished by the Bureau as a whole. Taken as a whole, I think the problem of the protec-tion of the crops from frost has been one of the pieces of work that the Department of Agriculture can well be proud of. The Weather Bureau has been the leader in this work, though lately other branches of the Department have taken it up. The problem is a twofold one; first the weather man's own proper work of giving accurate warning of the frost twelve or twenty-four hours in advance, so that the grower can fill his askets, fix his fires, or spread his cov ers, and thus save his oranges and jem ons. Concerning this it will be enough to say that last year there was not a orange belts of California. The work was perfect so far as forecasting goes a thing that ten years ago seemed im-

"Regarding the second part of the problem, namely, the devising of the best methods of protection and the study of the physics of frost formation, the work speaks for itself."

So much has siready been written concerning frost protection—by means of orchard heating, smudging, irrigation, spraying, and otherwise—that I need not enter into the subject here further than leaders both in devising new methods and in disseminating information con cerning them. The authoritative litera ture of this subject consists chiefly of publications issued officially by the Weather Bureau. The Bureau is conducting a campaign of education in this line, the value of which is simply incal culable. Here again the Bureau justi fies its existence, in terms of dollars and cents, and we have something tangible to offset the loss of Farmer A's hay

CONCERNING CRANBERRIES. Even government bureaus have their hobbies, and just at present the Weather Bureau's is cranberries. The value of the cranberry crop—all of which is grown in the three States, Wisconsin, New Jersey, and Massachusetts—is insignificant compared with that of the great staple fruits and cereals of the great staple ritts and contain of the cramberry bogs against the surprises from frost to which they are particularly liable as compared with other fruits is a peculiarly difficult and there-

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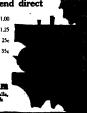
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fore attractive problem, and to this m the Bureau has turned its earn est attention. The work in this line was begun some years ago by the present chief of the Bureau, and has latterly been taken up by Prof. Cox, who has just published a complete account of his work in the form of a Weather Bureau bulletin. This bulletin is commended to the attention of any one who desires to see, in the first place, how many fa may enter into the problem of making practical rather than academic fore a particular industry, and, the second place, how thoroughly Weather Bureau investigates every side of such a question. It is not simply a matter of saying when such and such a temperature will prevail generally over the area in which the bogs are located. The season of the year, the temperature of the soil as determined by previous than by current meteorological conditions, and finally various local pecultorities of the hors, all have to be taken into account before the forecast is justified in warning the growers that flooding—the usual method of protection -is in order.

OF NOTE OF A CONTROL OF THE STATE OF THE ST

THE FLOOD SERVICE. The Weather Bureau points with pride

branch of forecasting in which--to use a hydrological metaphor—the high-water mark of accuracy has been attained. The Bureau is charged by Congress with the duty of gaging the rivers of the Unite States and issuing flood warnings. have not space to describe the elabora organization of this service, with its gages along every large river and its corps of 600 special river and rainfall obrvers, who receive a small compensa tion for a few minutes of their time each day. This work, again, is one calling for the highest talents and the utmost fidelity on the part of the few men to whom it is intrusted—the Chief of the River and Flood Division at Weshington and the officials in charge of the 55 river districts into which the country has been Thanks to their energy and enterprise, the bureau is able to predict stage of a river at a given within a limit of error of a few inches, the word "research." from three or four days to three weeks in advance. When it is considered that thousands of square miles of agricultural land are subject to overflow in a time of high water the enormous value of flood warnings to the farmer will be appreciated

MATTERS THAT ARE FUNDA-MENTAL.

The work of the Weather Bureau for agriculture represents the application. on a truly colossal scale, of knowledge that has been slowly and painfully ac quired-in part by men who hardly know a plow from a harrow. Non omnio possumus omnes; a machine needs to have many parts, each with its ap-pointed work to do. So it happens that ome of us must stay at home and manufacture the ammunition that the army in field is to put where it will do the most good.

The headquarters staff of the Weaths Bureau has its own tasks and its own problems. How some of these concern the farmer I shall try to show.

Agriculture is compounded of climate and soil, and the more we know about these two things the better use we can make of them. The study of the cli-mate of the United States is efficially allotted to the Weather Bureau, that of the soil to the Bureau of Soils; but the

we subjects overlap to some extent.

The archives of the Weather Bureau The archives of the westner sureau contain millions of meteorological ob-servations, some of them dating back a hundred and fifty years. These observa-tions are the raw material from which climatic statistics are made; and the work of putting the latter tota final and usable form has been done largely, though by ne means entirely, at the cen-tral office of the bureau in Weshington.

These statistics are directly or indirectly useful to the farmer in a sariety of ways. They tell film, in the dest place, just what parts of the an average, sufficient rainfall and sun-shine to make farming a profitable ven-ture, and in the second place, after he has chosen his farm, they tell I crops it is best adapted to produce.
he has settled in a semi-arid region, the tell him whether, and to what extent rigation will be necessary; or, if he is a dry farmer, which of the several regimens of dry farming will be the most appropriate. The importance the farmer attaches to such information is shown by the extent to which it is sought. some of the western stations of the Bureau it is said that from 30 to 50 per cent of the correspondence is with persons seeking information regarding the climate of agricultural and pastoral

Indirectly the same statistics serve the farmer by facilitating the work of plant introduction so extensively carried on by another branch of the Department, the Bureau of Plant Industry; and, to a greater or less extent, they enter into nearly all experiments undertake ficially or otherwise, for the improve-ment of agriculture in this country.

So much for geographical climatelogy. There are, however, many other branc of meteorology that play their part in scientific agriculture. There is pi ology, for example-still a batting subject, in spite of the enormous amount of labor that has been expended upon it: there is evaporation, which, though it still refuses to submit itself to general formule, has been studied empirically with practical results; there is solar radiation—a subject of the utmost importance to agriculture, which, for lack of proper appliances, has been neglected until quite recently, but has now been taken up by the most progressive meteorological institutions of the world. In these subjects, and many more, the Weather Bureau is doing, or has done, its part: and if the farmer has not been the sole beneficiary, why so much the better for the rest of the community.

The Weather Bureau is not afraid of It has put this word into the title of the institution of which it is most proud—the Mount Weather Research Observatory. Of this fine institution I have not space to write, beyond stating that it is a standing refutation of the idea that the government is doing nothing for pure science

PROGRESS.

Humanity moves ahead at a breathless pace nowadays We rarely take time for retrospection; when we do, we are amazed to find how much ground we our progress.

In looking back over the past few years. I find that some of the latest advances made by the Weather Bureau are almost revolutionary. Take the news paper weather map—officially called the "Commercial Weather Map," but quite as interesting to the farmer as to the mer hant. A year ago it did not exist as an official undertaking. The Bureau pub lished its own maps, in the form of broadsides, issued from a hundred sta-tions. Their total of reulation was forty or fifty thousand. A happy inspiration suggested the utilization of the vast machinery of the daily press for the dissemination of the same information. Today the map is published in a hundr newspapers, and reaches, say, twenty milion people daily.

The daily synoptic chart of the north or hemisphere, and its corollary the weekly long-range forecast, are products of the last three of four years. This amof the last three or four years. This an-bitious undertaking is an expression of the most advanced conceptions of the proper coops of measureless. Visit inter-we have found set here intrused in the relation between widely important confine-ed the introductors. We know, the

in Ales is not unconnected with a rainfall of India, and that e strength and direction of the air-ouretrength and dire a great deal to do with the Nile flood. relative meteorology" is engaging the attention of an army of investigator all over the world, and an international commission has lately been formed to dict the study of this fascinating subject. In the practical utilisation of the idea America leads the world, and the United States Weather Bureau is, up to date, the only institution that assembles daily, by cable, the meteorological obserof a chain of stations extending around the globe, and makes them serve

the basis of weather forecasts The daily weather map of the northern phere is prepared in manuscript at Washington, and is not published. With its sid the forecaster is enabled to feel the nulse of the atmosphere as a who not merely the limited portion of it that hannens to He over the United States. It would be rash to predict what this experiment will ultimately lead to, but to the forecaster it has brought the sense of relief resulting from the removal of the narrow bounds that formerly bemmed in his view. The tangthe result to the public current from the electrodes and the lication of a forecast every Sunday of the broad features of the following week's weather—the prospects of general rains over the corn belt; the danger of spring frosts in an important truck country; the probable course and rate of movement of large cyclonic and anti-cyclonic areas— sometimes traced from a point of origin the western side of the Pacific-and the weather likely to attend them over an extensive region. Just how much these wholesale forecasts of weather mean to the agricultural public each farmer must decide for himself. As a factor in determining the prices of farm products they have already made themlves felt, and therefore no farmer can be altogether indifferent to them.

THE KEYSTONE OF THE ARCH.

The foregoing is only a fragmentary description of what the Weather Bureau is doing to-day for American agriculture An exhaustive presentation of the subject

When I began to write I intended to refrain from the congenial task of eulogising the two men to whom, above all others, is due the credit for the remarkable progress the Weather Bureau has made iring the past decade, and for the envishle position it now occupies as an agency in promoting the nation's welfare A compliment paid to one's official superiors is apt to sound perfunctory.

However, in bringing my story to a close I seem to have built a more or less elaborate arch and left out the keystone. Prof. Willis Moore is much more to the

Weather Bureau than its official head. He is himself the embodiment of its spirit. The best qualities that distinguish the rank and file of the service are his qualities, more or less successfully amulated by men who look to their chief for evenue no less than for precent

To Secretary James Wilson the Weather Bureau is indebted not only for freedom to develop itself without harassing restrictions, but for active aid and encouragement at every stage of the proess. There have been cabinet ministers in America and elsewhere—who have haid a heavy hand of bureaucracy and narrow utilitarianism upon the scientific idealists serving under them. I have in mind the complaint recently made by the mean are comparint, recently made by the director of one of the foreign weather services that the official Shylocks are perpetually clamoring for ""sentra," and are only momentarily appeared with the nave that some unpromiting argosy of lavistigation "hate right" come to bar-

the property of Agriculture as of 45,977.

Neon Light By Our Berlin Corre

MR. GEORGES CLAUDE, the well-known pioneer in the field of gas liquefaction, recently submitted to the French Physical Society the results of his work on neon light

The remarkable brilliancy possessed by the spectrum of that gas and the fact discovered by Collu, that a glass tube taining neon and a mercury globule made to shine by shaking in the dark, in-duced Mr. Claude to undertake some experiments on the possible use of that gas for lighting purposes, the more so as according to Prof Bouty's work, its dielectric constant is extremely low

His attempts to improve the light of mercury tubes by combination with neon light failed to give any satisfactory results. Endeavors made to use pure neon directly as a source of light proved far more successful, though the fact that neon is liable to be contaminated with traces of foreign gases (mixed with 't walls of the tube) caused much difficulty. These drawbacks were eventually over come by fitting the neon tube with a car on reservoir immersed in liquid air, as it is well known that charcoal at low tem peratures has a strong absorbing action upon guses.

the recent Paris automobile Claude in conjunction with the Moore company installed four neon tubes, each company installed four neon tubes, each 38 meters in length, which gave quite surprising decorative effects. As the light of these tubes is very rich in red rays, the facade of the Grand Palais seems to be immersed in a sea of bright golden light

As no accurate data on the Grand Palais installation are so far available Claude in the meantime gives an account of the working conditions of a tube six meters in length and forty-five millimeters in diameter exhibited before the

The potential difference between the terminals of this tube, on account of the low dielectric constant of neon, is only about 1,000 volts; just as in the case of the arc discharge, this potential difference is found to decrease somewhat with increasing current intensities dropping from 1 100 to 980 volts as the current intensity increases from 01 to to be 850 watts, corresponding to a power factor of 09, about the same as observed by Wedding in Moore tubes

tal of 1,320 candle-power Considerably better results should b obtainable in longer tubes, since much energy is lost at the electrode, a loss which remains constant as the length of means of auxiliary electrodes, this loss total energy consumption of 850 watts

Agricultural Colleges and Schools

Since October, 1908, the number of in-stitutions in the United States giving instruction in agriculture has increased from 545 to 875. Departments of agricultural instruction have been established in 38 public high schools; 214 instituin 38 public nigh scutors, at-tions now give teachers' training courses in agriculture. Farmers' institutes are now organized in every State; the attendprintigation "asts richly come to bar-spr saddenly." and sprintings to be able to point to the a privilege to be able to point to

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an official of exactly the opposite type. The Weather Bureau is what he has helped and encouraged the present chief 1911 ATLAS OF THE WORLD FREE

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Electricity

Compulsory Wireless Telegraphy.—As order has been issued by the Italian gov ernment making it compulsory for all vessels carrying emigrants from Italian ports to be equipped with wireless tele-graph apparatus of the Marconi type. uipments must have a range at least 187 miles.

Pecket Receiver for Radiotelography.— It is announced that Prof. Belar of the Laibach Observatory has invented a chean and handy pocket receiver for wire telegraphy. Experiments with this new instrument are said to have been most successful. No detailed information as to the construction or mode of operation of the invention is available.

Metal Sheath for Return Circuit. Germany rubber-insulated wires are ordi narily protected by steel tubes, which are joined together by overlapping. Experi-ments have recently been made to de-termine whether these tubes may not be used for a return circuit or an earthed neutral wire. It was found that they answered the purpose admirably, and that the voltage drop at the joints was considerably less than the maximum permis-

Electric Trucks for Docks. -- In order to facilitate the handling of freight and express matter on steamship docks, the Hamburg-American line has recently been experimenting with electric trucks. The company has adopted a truck mounted on three wheels, capable of car rying a load of 5,000 pounds at the rate of four miles per hour It has been proven that one of these trucks will do the work that heretofore required six men with the common hand trucks.

Incandescent Lamps in Germany.—Our consul at Bremen, Germany, states that the export trade in incandescent lamps from Germany has grown yearly 909 it amounted to \$7,857,000, as against \$4,780,000 in 1908 ,780,000 in 1908 The lamps were ex orted to Great Britain, Austria-Hungary Russia, Denmark, and Italy. On the other hand, our consul at Vienna, reporting on incandescent lamps exported from Aus tria-Hungary, states that the entire value for 1909 was \$816,343, of which the larger part was sent into Germany.

Annual Electrical Shows,-The suc cess of electrical shows throughout the country has been so great that they have become an annual feature in several cities. This year Minneapolis. Minne has held its second annual electrical show, extending from January 6th to February 4th, and as usual in such exhibits the illumination was exceedingly attractive Electrical shows are now held annually in New York, Chicago Philadelphia and Minneapolis. One of the leading features of the shows this the reading restures of the shows this year has been the development of the efectrical vehicle. Electricity in the household attracts, perhaps, the most popular interest in these exhibits.

Resistors and Insulators for Electr Heating Appliances. -- In a recent address given before the Chicago branch of American Institute of Electrical En rs, Mr Charles P Madsen discuss gineers, Mr Charles P Madsen discussed the subject of "Electric Heating Develop-He referred to the three class of materials used for the resistor; first loose compositions, which develop heat owing to loose contact, but which are objectionable owing to the fact that with the rise of heat the resistance is reduce 1: second, the chemical precipitates. in which a thin conducting deposit on an insulating material serves as the resistor, and third, the various metal wires. Of the last class, alloys of bickel-copper and nickel-chromium have proved the most satisfactory. In connection with these resistors, the subject of insulating materials which will also resist the action of heat-is important. Lava, porce-lain and mice have proved the most successful, while asbestos, glass and water scrap, glass lose their efficiency when heated. a tou.

Steel Mail Cars.—A provision has been inserted in the Post Office appropriation bill to the effect that hereafter the Post master General must make no contr for any mail cars other than those built of steel or some non-combustible ma terial. A stipulation was also included that after January 1st, 1916, no weeder car shall be used in any way for the sailway mail service

All-steel Suburb delivery of all-steel suburban co use of the suburban service of the Penz sylvania Railroad in New York, has been made. The coaches, which are 54 feet long, seat 82 people, and by intelligent design the dead weight of the car pe passenger has been reduced from 1,510 bounds in the old wooden coaches to 1,078 ounds in the steel coaches.

For Erecting Gatun Lock Gates.—A suggestion of the massive character of the Panama Canal lock gates is found in the recent delivery at the Isthmus of two truss bridges 11 feet wide and 134 feet long, which will span the locks and be used for erecting the massive lock gates. Each bridge will carry a railroad track, from which locomotive cranes will handle the steel during erection.

Bigger Drydocks Needed.—Ships like the "Mauretania" and the new "Olympic," 790 and 8821/4 feet long, respectively, car not dock on this side of the Atlantic The largest dock at New York, situated at the navy yard, is only 700 feet long and there would certainly seem to be a call for the construction for one at this port with a usable length of not less than one thousand feet.

California Road Improv of the progressive State of California have ratified an act of the Legislature calling for a bond issue of eighteen million dollars to construct a system of State highways connecting the county seats of California. More than this, ve rious counties have authorized bond issues for road improvement to a total amount of \$7,300,000. California is cer tainly alive to its inte

Proposed Interstate Huds The New York Interstate Bridge Bridge,—The New York Interstate Bridge Commission has filed a report at Albany declaring in favor of a site for a Huc son River bridge with a main span of 2,800 feet, between 57th and 63rd Streets If constructed, this will be the longest If constructed, this will be the longest in span in the world, the next longest in their order, being the Forth bridge of Scotland, 1,710 feet: Williamsburg Bridge, New York, 1,800 feet; Brooklyn Bridge, New York, 1,470 feet.

New [Warship Construction.-The House Naval Committee bill calls for the expenditure of \$125,421,538, of which \$34,270,816 is for new warships. This programme provides for two 27,000 battleships, to cost \$11,835,408 each: two colliers, eight torpedo boat destroyers and four submarines, the latter to cos \$500,000 each. The committee recommends the repeal of the provision in last year's naval act, calling for the construc-tion of the battleship "New York" at the New York Navy Yard. This change was recommended on account of the much greater cost of navy yard con-

Removing Quebec Bridge Wreck.— When the Quebec Bridge collapsed 17,000 tons of steel fell into the St. Lawrence River, about one-half of it constituting the anchor arm, being in shallow water. In removing this material, much of which is in large and heavy sections, the meta has been cut to sizes that can be han dled, partly by dynamite and p the use of the oxy-acetylene torch. cutting a member in two by dynamite a continuous row of dynamite sticks is at to cut and explode. According to the first point of the compression members to reduce the compression members to scrap, which is sold to Montreal for



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Het -Wath ng from a height of 280 feet in military monophine at Doust, on February 5th, the wings from a height of 250

At the reque st of Major General rd Wood, Chief of Staff, Senator Warren offered an amendment to the army appropriation bill to the effect that 825,650 of the total of \$185,000 for seron autios be made immediately available for the purchase of aeroplanes. This amendment was passed, and General Allen, of the Signal Corps, is now negotiating for the purchase of several heavier-than-air

The Second Acro Show at Beston The second annual aeronautic show will be held in Machanics Building, Boston, from the 20th to the 25th instant. Many more aeropianes will be shown than were exhibited last year, as well as a big line of aeronautic accessories. The at models of Wright and Curtiss biplanes will be exhibited, as well as thos of the less well known manufacturers. A feature of the show will be the mancarrying kites of Samuel F. Perkins with which he has lately sent two men aloft from the cruiser "Pennsylvania."

Harkson Mahas Military Flight.—On February 7th Mr. Harry Harkness, the amateur aviator, who has heretofore had but small success in flying his Autoin-ette monophine, flew from Fort Rosecrans, near San Diego, to the American camp on the Mexican border at Tis Juana. He carried a weighted message from Major McManus to Lieut. Ruhlin who was in charge of the troops. Cir-cling above the camp at a height of 100 feet, Harkness dropped the message and returned. His flight lasted 56 minutes. and for a good part of the way he was over the cosen. The total distance cov-ered was about 46 miles, and the average speed nearly 41 miles an hour.

Real Scouting by Acreplane.—Mr. R. F. ew Wright biplane, and Lieut. B. D. Poulois has been commissioned to fly it above the Mexican border during the hos-tilities now going on between the Mexican government and the insurgents.

There are 1,400 miles of border to be patrolled, and the government has called for volunteer aviators to help perform this duty. In response, Charles K. Hamilton volunteered his services, and on Feb-ruary 19th, in an 18-minute flight, crossed the Rio Grande from El Paso, Texas, and reconnoitered at an altitude of 1,000 feet above Juares, locating Mexican troops.

above Juares, locating Mexican troops. Bagland's New Navral Antella, "Further particulars are now available respecting the naval airship now under
construction for the British poverment
et Espaine, "Furness, England. The
propulsive power is derived from two
sats of eight-brilinder Wolseley engines
of 300 horse-power each. To each of
these engines are attached eight sheet
metal tanks, each having a capacity for
2,000 gaillons of gasolins. The total storage capacity is 32,000 gaillons. These
tanks are welded together in oil-tight
sections, insuring the hegesancy of the sections, insuring the husyancy of the sirchip should an accident or injury oc airship should an accident or shury co-cur to any section. The precention, how-ever, entails the addition of some 300 yrands of airminium upthus. The engine is dissipated to run at 500 seventutions par-minute, and a speed of 45 males an hour is expected to be obtained from the

Science

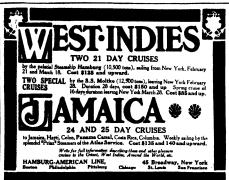
Height of the "Upper Inversion" in the Atmosphere.—According to a recent cus-cussion of the temperature of the upper air by Albert Peppler, the following fig-ures represent the average altitude of the "upper inversion" at various latitudes, as deduced from the abundant data of observation now available: North pole, labout 8 Witnessers northern Burone. about 8 kilometers; northern Europe, 10.69 kilometers; central Europe, 10.98 kilometers; centra: Europe, 11.20 kilometers; southern Europe, 11.20 kilometers; 30-37 deg. N., 18.05 kilometers; 19-30 deg. N., 14.51 kilometers; 1 deg. E. (German expedition to East Africa), 15.21 kilometers.

The Highest Kite Flights.—The art of flying kites is carried to its greatest perfection at the large aerological observatories, and the best records of altitude up to date have been made at Mt. Weather, Va., and Lindenberg, Germany. former station is 525 meters above sea level, the latter only 120; a circumstance that should be remembered in comparing the records made at the two places following list of the highest flights, recently published by Dr. Assmann, given the altitude above the ground, not above sea level: 1. Mt. Weather, 6,740 meters; 72. Lindenberg, 6,660 meters; 3. Mt. Weather, 6,519 meters; 4, Mt. Weather 6,484 meters; 5. Lindenberg, 6,380 meters; 6, Mt. Weather, 6,379 meters.

A Proposed International Magnetic Union.—Dr. L. A. Bauer, director of the Department of Terrestrial Magnetism of the Carnegie Institution, contributes the current number of Terrestrial Mag-netism and Atmospheric Electricity a long review and criticism of the caree of the International Commission on Te restrial Magnetism. This commission is now a subordinate body under the con-trol of the International Meteorological mmittee, a circumstance arising fr the fact that in nearly all countries the official magnetic service is identical with the official meteorological service. Dr Bauer's editorial leads up to a plea for an independent International Magnetic Union, organized on similar lines to those of the International Union for Co-operation in Solar Research

The Earth from the Moon.—As we ook up through the transparent atmosphere on a clear night and see the moon beaming brilliantly down upon us, every one has at times been moved to speculate upon the wonderful sight the tinents and oceans of the earth must present when viewed from the lunar regio As a matter of fact, however, we are assured that a man on the moon would catch but fleeting glimpses of the outlines of our continents. One authority has stated that the true radiating surface of the earth, as a planet, is chiefly the water vapor at an elevation of 4,000 (13.120 feet), or more, above the sea moon would see the features of the earth dimly outlined in the glare of light re-flected from the atmosphere.

The Climate of Queensland,—The Water Supply Department of Queensland has just published an important collection of rainfall statistics, compiled from the observations made at over five hundred points in the State during the ten years 1897-1906, inclusive. Data of the ether climatic elements are to be pub-lished in a separate volume. These publications will fill a serious gap in the literature of geographical elimatology, and, in addition to their scientific value, and, in addition to their scientine value, will benefit this portion of Australia by correcting false impressions concerning its climate that have doubtless kept away of the same amount of rain as have the dry farming regions of our own wastern



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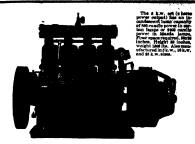
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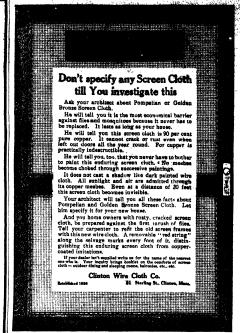
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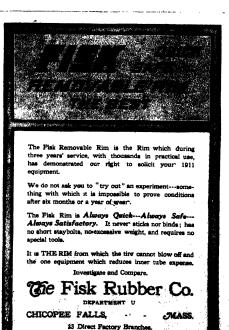
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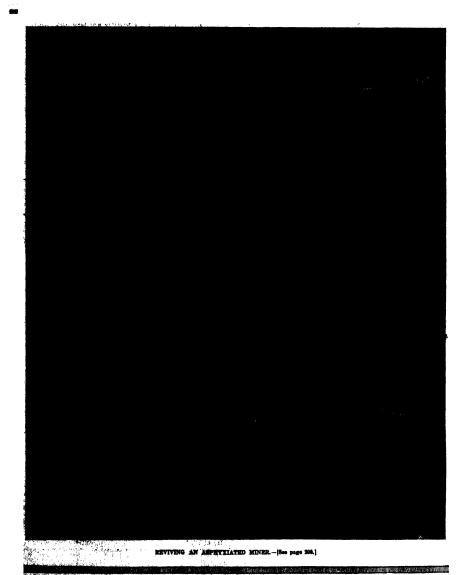


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NEW YORK, FEBRUARY 25, 1911



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The purpose of this journal is to record accurately and in simple terms, the world's progres in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science

Our Decadent Merchant Marine

HERE was a period during the middle of the last century when the merchant marine of the United States led the world. For many decades past, it has seen a strady decline Fo-day it is threatened with absolute extinction Our shipit is threatened with absolute extinction. Our subject progress register for forcing trade, now amounts to only 788,517 gross tons the smallest amount, if we except the year 1898, during the past seventy years. Subtract from this tonnage vessels which have outlived their usefulness, vessels in the trade, between Atlantic and Pacific coast ports by way of the 18th years of the Lathnus of Tchunathepte, which, although ea goes can be carried only by American ships, are required to be registered and subtract also tonnage on the Yukon River, and but little is left outside of the steamers built for the ocean mad of 1891, and the five trans-Pacific liners which fly the American flag Last year, American ships carried only ican flag Last year, American ships carried only 8 7 per cent of our exports and imports, the smallest percentage, if we except the year 1901, in our his

tory

It is to Congress that the country must look for
the first movement in setting, right these altogether
impossible conditions, and the most workable method
for starting the great work of reconstruction would
be an extension of the ocean until act of 1891. The
bill now before the Senate provides that American
ocean mail steamships of 16 knot speed or upward,
of 6.000 cents there can shall be not be and of 5,000 gross tons or over, shall be paid by the Postmaster-General for carrying the ocean mails \$4.00 a mile on routes to South America, south of

as 400 a nulle on routes to South America, south of the lquator, payments to be made for the outward voyage only. The bill prohibits the award of contracts to any bidders engaged us competitive transportation, or engaged in the importing or exting business. Contractors must not give any priference of advantage to any particular person, company, firm, corporation or locality, or to any particular description of traffic. Contracts are to be awarded to those bidders who offer the highest searcome size of going speed

Now the causes of the present deplorable con-dition of our once famous fleet of ships engaged in dition of our once lamous firet of ships engaged in the foreign trade are simple, easily understood, and impossible of contradiction. In the first place, ton for ton, a ship of a given size can be built more cheaply in foreign yards than in our own. The ship, when once affoat sets and upon her lift of useful service with a perpetual handicap upon her profit-earning capacity represented by the interest on her higher first cost The difference in cost be on her higher first cost. The difference in cost be tween American-built and foreign-built merchant ships is not so great to day it is true, as once it was The remarkably low price at which ship plates and other structural steel maternal are product in our mills, conjided with the development of large ship-building eritableaments provided with the most up-to date plant, has street to bring the cost of construction much nearer the European figure but the fact remains that the average to-day is somewhat higher at this country. If, under the fostering car, of the Government, exercised through suitable

mail subsidy legislation, our merchant marine abould begin to grow in numbers and tonnage, there smalls be an increase in the number of ship yards and an increasing flow of orders to those that already exist. The ultimate result of this increased activity would be a somewhat lower cost of production

would be a somewhat lower cost of production.

The principal cause of the present stagnation is
to be found in the much greater cost of running
Ann recan ships, as compared with ships sailing
under forcign flags. Existing laws for the protection
of American seamen, and for their general comfort,
demand that they shall be housed, fed, and generally
and for our ways whose cost is far are far than cared for on a scale whose cost is far greater that obtaining on foreign ships. The pay both of officers and men, is higher and it is a fact that, even if we could build always as cheaply as the foreign shippyards, the extra cost of running the ships would be sufficient, on many steamship routes, to practically wipe out any profits

In vi w of these conditions, it can be said that to all intents and purposes, the construction of for-orga going merchant shipping is an infant industry which will require in the carly years of its development the same federal recognition and support which has enabled the United States during the past quarter of a century, to found, develop and bring to a lusty growth and vigorous manhood, many industries, which to-day are among the most extensive and successful in the country

We note that in his last report the Commissioner of Navigation urges the necessity of giving federal and to such American shipping as will make use of the Panama Canal, whose formal opening will take place on January 1, 1915, some four years hence Unless it is proposed at the outset, he says, to abandon entirely to foreign shipping, ocean communica-tion between the United States and the west coast of South America, by way of the Panama Canal legislation to secure, the establishment of American mail lines through the Canal should be undertaken It is pointed out that there is ample preceat once it is pointed out that there is ample precedent for the payment from the Treasury of the United States of tolls which will accrue on vessels of the United States passing through the Panama Canal It is sufficient to refer to the fact that as a means of standating the development of national shipping, Russia, Austria-Hungarv and Sweden re-fund Sines Canal tolls to such ships as use the canal Indirectly, through their subsidies to national mail indirectly, through their assosses to astonas mail lines using the canal, such a refund is, in effect, the policy of Germany, France, Holland, Japan, Italia and Spain It is significant, moreover, that the British and Oriental streamship company subsidy of \$1,000,000 happens to be almost exactly the sum of the Sues C anal tolls.

If we remember rightly, the United States is pay-g out annually between 300 and 400 millions ing out annually between 500 and 400 millions of dollars to foreign steamaphy companies for carrying its foreign commerce. Government assistance amounting to but a very small fraction of this sum, would ultimately put us map position to carry this trade curselves. The foreign expression of the sum, would ultimately put us map position to carry 400 millions of dollars in opening up via Panama shorter sea routes to the South American coasts. The remutature of Canal dues to American built and manned ships would go far to secure the bulk of this trade for American shipping.

The Importance of a Wood Collection in the National Museum

National Museum

Public attention should be directed toward
the urgent need of a collection of North
American woods in the National Museum at
Washington The lumber industry of the United
States stands fourth in value of its product
Yet, there is no place in the United States where a
complete collection of North American woods is
chibated except in the American Museum of Natural History, New York city Timber merchants
and wood users recognize the need of upen technically trained for identifying woods. Such work
can only be carried on in connection with a complete collection of authentic wood specimens. The
dempad for authoritative information regarding comdemand for authoritative information regarding com-mercial woods is continually increasing.

Most large colleges and universities are provided

Most large colleges and universities are provided with tensas for giving practical instruction in assaying Ores and precious stones are in measure collections for observation, study, and experiments. Every opportunity is afforded the student to become familiar with the subject in all its phases. It is exactly different when one looks for the same symportunities at that study of woods which is technically known as "sylology". Institutions of learning have collections of mosses and alge obtained through considerable expense, they have microscopic slides of desmids and distations which have use instigated to the average layman and only to comparatively few

systematists. The consents value of the plants represented by their abjects to said your compared to the product of the formal, and you latter, has received very little recognition in matic museum work.

matic nuesum work.

There are nuncerous purposes, cach one of which in itself would be amply sufficient to justify a sicolar tion of authentie wood samples in the National Museum. The chief purposes are to fontract the public and to furnish material for the investigator. In the main, the collection should canaist of a reference collection and exhibition material. A collection of woods should not alone be a store-bouse of feat, but it is important that revorsiten.

A collection of woods should not alone be a store-bouse of facts, but at is important that provision should be made from the start for a laboratory. The aim of a reference collection is two-fold, the one struing toward a knowledge of the structure of wood and the other toward the diffusion of that knowledge. The former consists in investigating and discovering new facts, while the latter tends toward educating the people and applying the dis-covered facts to the advantage of all. Aside from the need of this cellection there should be a unuseum collection similar to the one in the American Museum of Natural History. New York city. No pains collection similar to the one in the American Museum of Natural Ribetory, New York city. No pains should be apared to accure similar maternal for exhibition purposes in Washington In addition to the exhibition samples and enlarged micro-photographis of transverse and longitudinal sections, it will be necessary to show specimens of leaves from the trees and a mag gring the range of growth and information as to the uses of the wood Not only should every effort be made to obtain representative specimens of native woods, but the plans and buildings should be large enough to hold woods from other countries. It has been estimated that the collection of a complete set of North

mated that the collection of a complete set of North American wood samples alone would require a million dollars endowment Whatever the expenditure, it would be an unusually good investment of national dollars endowment whatever the expensioner, is would be an unusually good investment of national funds. The buildings and contents of the South Kensington Museum in London cost Grest Britain about five million dollars, and competent authorities about five million dollars, and competent authorities critimate that an auction on the premises would bring not less than one hundred million dollars. If sufficiently also the sufficient is not doubt that a donation in the form of specimens and money, worth many times the original outlary, will be received Large importers of foreign high-class cabinet woods will be anxious to exhibit samples of their choice woods. Not a few people are attracted by a collection of woods as much as by one of agricultural products. Undoubtedly a wood collection appeals to the public, and where this is the case much that is aluable will soon find its way to the museum Forester with said and ability will doubt museum Foresters with seal and ability will doubt inuscum foresters with seal and ability will doubt less collect and donate samples of wood from all parts of the world. All that is required is to prepare the place and the proper publicity will guarantee the material in due time. Invaluable material aster the material in due time. Invaluable material o, opp he readily obtained through consulates. Other museums having material in storage would doubtless loan or adonate a considerable share of it to the national collection. Every country in South America would be glad to exhibit in the capital of the United States representative samples of the product of their forests. There can be no doubt that a matismal harithution such as this would attract men of tional institution such as this would attract men of learning, for it would open an entirely new line of work from which the industrial and scientific world could draw invaluable information. Foresceing the benefits which would result to science and industry by the successful establishment of a representative wood collection, it seems doubly imperative that immediate steps should be taken to carry these sug-gestions into effect

Refined Measurements

Refined Measurements

If extreme delicacy of solentific measurement is stopping by an appearatus of English invention for comparing official standards of length Its action depends upon the interference of light-wave, causing shadow bands, the width of which is half the wave-length of the light employed. The red rediction from hydrogen or cadmium is need, and its wave-length is, say, the fifty thousandth of an inch. The machine carries two microscopes, one of which is attached to one of the glass place reflecting the light and producing the interference bands. First the recognised standard, red--asy the imperial standard yard--is placed under the two microscopes, and one of its terminal marks in brought under the product the spider-lines of each. Then the rad to be pasted its aphetication, and one of its terminals in accordance the spider-lines of each, Then the rad to be pasted as a substituted, and one of its segminals its accousticly adjusted. If it varies from the length of the standard, the other inferoscope, carrying the reflective, must be shifted until coincidence is abstanced. The number of bands that move past during the self-line, multiplied by the heli-grave film reads.

Professor Gisbert Kapp

A Distinguished Electrical Engineer

By P. F. Mottelay

PROF. GISBERT KAPP, at the present time or cupying the chair of electrical engineering at the liversity of Birmingham, England, is a man of broad training and wide and varied experience. By birth he is, on his father's side, of German extrac tion; his mother was Scotch, and in later life he himme a naturalized British subject. born at Mauer, near Vienna, Austria, in 1852. He received his first scientific training at the Polytechnicum at Zurich, which he entered in 1869 and where he studied under Gustav Zeuner and the Wilhelm Kohirausch. He received from this institu-tion his diploma in mechanical engineering, and pro-ceeded thence to the Arsenal at Pola, where he spent twelve months and gained valuable experience marine engine work.

At the age of twenty-two he left his native country and took up his abode in London, where he occupied the position of chief draughteman in the

well-known establishment of Gwynne & Co. hydraulic and gas engineers. He remained in the employ of this firm for five years, during which he had frequent opportuni-ties of visiting different places on the Continent, notably in Holland, in connection with the installation of steam pumping and other plants. He subsequently became the technical representative of Mesers. Hornsby & Son", Limited, a large firm of agricultural implement manufacturers, located at Grantham, England In the employ of this firm also his duties took him on extensive travels, covering practically the whole of Europe, and extending as far as Cyprus, Algiers, and even Egypt He thus made a study of the conditions under which agricuiture was carried on in widely different ocalities, and rendered signal services to his firm by ascertaining the various points and features in which they were in a po-sition to benefit foreign consumers through the introduction of their improved steam and other implements

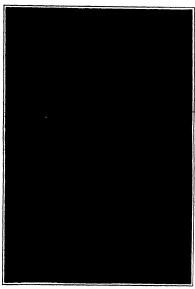
On his return from one of these trips he d the great Paris electric exposition of, 1881, and was so much attracted by what he saw there, and by the field which appeared to be opened for new industrial evelopments, that he decided to enter this branch of work, which seemed to offer greater and more profitable scope than the enterprises with which he had been until that time identified He accordingly left the employ of Mesers Hornsby & Sons, and devoting himself earnestly to the study of electrical engineering, entered the firm of Crompton & Co, being appointed manager of their works at Chelmsford. He found here every opportunity that he could have desired for the technical research for which his mind was eminently fitted, and, in collaboration with Mr. Crompton, works a number of improvements, notably in dynamo design, which were ultimately made

the subject of a series of patents. In 1885 he resigned the subject or a series of patents. In 1880 me resigner, his position with Messra Crompton & Co., and estab-lished bimself as consulting engineer in Westminster Among the inventions made by him up to this period may be mentioned the introduction of compound winding for dynamos, and a class of electrical measuring instruments, wherein permanency of calibration ing instruments, wateren perimanency or caltoration is obtained by the use of over-saturated electromagnets. These inventions were worked out in conjunction with Mr. Crompton, and were protected by joint pagants. Bubsequently, Dr. Kapp received Independent patents for his special method of making dynamos self regulating without using two circuits on the field magnet; for a self-regulating are-light dynamo; for an alternating current dynamo; for a high-speed steam engine to be used in conjunction with continuous curengine to be used in conjunction with continuous cur-rent dynamon; for a system of alterating current dis-tribution linuaring constant gressure over an extended district, for boosting the return feeders on electric rallways; and for an alternating current generator. The technical explicitation of his invanions has been except in the hardle did W. H. Allen & Co., of Samblett, Johnson & PHHHH; of Chartton; Lawrence Samblett, Johnson & PHHHH; of Chartton; Lawrence Samblett, Johnson & PHHHH; of Chartton; Lawrence

Dr. Reign continued in this principe as consulting en-traces will be year 1894, when he was offered and housest the manufacture of the German

Society of Electrical Engineers During his tenure of this office, he functioned as editor of the Elektro-technische Zeitschrift, the organ of the society named. He had previously had experience in editorial work in connection with the journal then issued under the name Industries, but now known as Industries and

At this stage in life, Dr. Kapp enjoyed a growing popularity, and his patents and consulting practice were proving very remunerative. He was continu eing retained by various German municipalities and firms engaged in the handling of the traffic of the country The calls which he received in his professional capacity took him to all parts of Europe, and his advice in the construction of electrical tramways was sought in Norway, Italy, and Russia, while in con sultation on questions of municipal distribution of electricity, he was called among other places to



PROF. GISRERT KAPI

Zurich, Lucerne, and Winterthur. In these capacities he had added fully ten years to his valuable experience, when he was called, in December, 1904, to fill the newly created chair of electrical engineering at the University of Birmingham, England able management, the laboratories of this institution. located at Bourn Brook, near Birmingham, have de-veloped into one of the best equipped centers of instruction in this branch of work within the United

Prof. Kapp is the author of many books, the most important of which are: "The Transmission of Energy and its Transformation, Sub-division and Distri-bution (fourth edition, 1984), "Alternating Cur-rents of Blactricity," "Dynamo Construction, Electri-cal and Mechanical," "Dynamos, Alternators and Transformers," "Transformers for Single and Multi-phase Currents," "Electrical Engineering," "The Electrification of Railways" (being the lectures he delivered before the Royal Institution in 1908), "Elec trical Engineering Designs' (taken from modern practice). Many of these were translated into French, Italian, Russian and German.

He has read a large number of papers before varius societies. His first contribution, presented in 1885, before the Institution of Civil Engineers, and en-titled "Modern Dynamos and Their Engines," earned him the Telford premium and medal. This paper was

followed up during 1886 by another on "The Prede termination of the Characteristics of a Dynamo," read before the Society of Telegraph Engineers His paper "Alternate Current Transformers" appeared in 1888, and that on "Alternating Current Machinery during the early part of 1889. His three Cantor lectures on "Electric Transformation of Power" were given before the Society of Arts in the spring of 1891, and he has also lectured at Chatham School of Military Engineering on 'Electric Tianways and Alternating Currents' It should be mentioned that, while in Ber lin, he held an appointment as lecturer on electrical engineering in the Technical University of Charlotten-

Prof Kapp holds the degree of Doctor of Engineering honoris cause in two German universities He been president of the Birmingham University gincering Society, was for two years chairman of the Birmingham Section of the London Insti-

tution of Electrical Engineers, on the council of which institution he served three times, from 1891 to 1893, afterward acting as vice-president during the years 1907-1909, and becoming its president for the period 1909-1910 He is, besides, a member of the English Institute of Civil Engineers. and an honorary member of the Physical S ciety of Frankfort

The accompanying illustration, which is prepared from a photograph taken expressly for these pages, shows Dr Kapp in the junior students' laboratory of his department at the University of Birmingham In his face we read a combination of firmness and kindliness, which was no doubt jargely instrumental in gaining him the success which he has attained Since occupying the electrical engineering chair of Birming-ham University, he has had the opportunity of showing to advantage his great merits as a teacher, of which no better testimony perhaps exists than the reported constantly increasing attendance at his lectures and classes As an instructor, he happily per-sonifies that rare combination, the ardent searcher and born expounder. In private, he always invites the boune camaraderic that has won him so much of the open popularity he enjoyed on the Continent as well as in the different associations which he has been called upon to enter. He is considered very methodical, sympathetic, torceful, happily blending in his teachings deliberation of the truly scientific thinker with an animation that carries con-viction and gives evidence of his great interest in anything he undertakes

The Project to Make Paris a Seaport

THE project of enlarging the bed of the Seine so as to bring sea-going vessels to Paris is now being agitated, and Municipal Councilor Denis voices the general opinion that the scheme is entirely practical and is

what Paris needs above all for its future prosperity All the traffic which it loses because Antwerp and Rotterdam are nearer the interior center of than is the Havre seaport would then be gained \$25,000,000 which is annually paid for the transport of freight from Paris to London in order to be re shipped will be partly economised. Besides, the metallurgical and industrial eastern region will have direct connection with England, and there will be no fear that a canal from Basic to Lausanne on Lake car that a canal from Basic to Lausanne on Lake Geneva will take all the Swiss and Italian traffic away from France Another point is that the \$33,000, 600 for work claimed to be indispensable for pre-venting future inundations of the Seine will not be needed. All capital nut into the "Beste comment". All capital put into the "Paris-seaport" iect will be revenue bearing.

T is estimated that there are about 530,000,000,000 feet of timber on the national forests. Though the aggregate is great these figures show a low average per acre of under 4,000 board feet work of reforesting shows an encouraging progress Over 9,000 acres of reforestation were sown during the year Something like a half billion feet of timber were sold during the past year. The sales of timber on the national forests have been growing less since

New Things in Aeronautics

Height Recorder for Balloonists: Curtiss's New Flying Boat

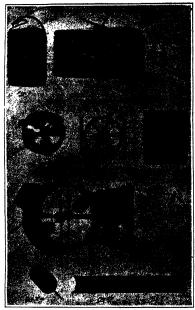
Measuring Your Height in the Air

THE problem of determining the vertical motion of a balloon is a complex one, and does not admit of wholly satisfactory solution; but there are several approximate solutions that answer ordinary, requirements. The simplest device consists in throwing from the balloon acrage or paper, which fall at a very slow rate through still air, and noting the movement of the balloon relatively thereto. This method is sometimes refined by using paper of different weights, each of which has a known rate of descent and is distinguished by a particular color This process, of curse, gives only the vertical movement of the balloon with respect to the surrounding air, which may itself have a rapid vertical component of motion. The same criticism applies to the various forms of vertical anemometer, certain of which are described in the following paragraphs:

Hypsometric determinations are quite ommonly based upon the readings of a barometer or barograph, on the assumption that there is an exact relation between al-titude and atmospheric pressure; but this assumption is fallacious, for the vertical gradient of pressure is, in reality, subject to rather wide fluctuations. Furthermore both the barometer and the barograph are somewhat sluggish instruments, and hardly to changes of pressure enough to be of much assistance in keening the balloon at the proper elevation, though their indications are indispensable for other purposes. A more sensitive instru-ment, analogous to the barometer, is the scope. This is made in various forms. A common one consists of a small reservoir inclosed in a metal case like that of a watch, the interior of which communicates with the outer air by a rubber tube. Part of the wall of the reservoir constitutes a flexible diaphragm, of rubber or metal, and is connected by delicate wheelwork with a needle, moving around a dial on the face of the instrument. While the rubber tube is open to the air, the pressure on the or posite sides of the disphragm is in equilibrium and the needle points at zero. In order to take a reading of the instrument the rubber tube is pinched, thus preventing the outside air from having access to the reservoir. If now the outside pressure is reduced, corresponding to an increase of altitude, the air inside the instrument presses the diaphragm outward, while outer pressure is increased, the disphragm is pressed inward, and these movements are communicated to the needle. The instrument is, in effect, a highly sensitive differential barometer.

An improved form of the statoscope is shown in Fig 1 Here the disphragm and the needle are replaced by a liquid column, which rises or falls in response to differences in pressure between the inner and outer air.

A further modification of this instrument is represented in a device recently intro-duced by A. Besteineyer, "called the pressure-anisometer (Fig. 2) while the statement enterty shows, at a given moment, the total rise or lail of the balloon since the bestiming of an observation, the variometer indicates the rate of rise or fall. This instrument requires no adjustment before reading. The reservoir, A. is a Dewar fask, communicating with the outside at by means of a capillary tube, B. and also connected with a manometer ubser. Of the owner of the total connected with a manometer ubser. When the pressure of the outside air diminishes, air passes out of the reservoir at B, but owing to the small bore of the tube the change in the pressure of the outside air funded the reservoir lags behind that of the external air by an amount that is proportional to the rate of pressure-change. The liquid in the rhanometer-tube, which is appropriately graduated, records this rate directly, in terms of vertical movement of the balloon when this balloon is stationary, in altitude, the instrument reads series when it is a fright.



Instruments for measuring speeds of secent and descent of balloons.



Skimming the surface at 40 miles an hour before rising.



Side view of acceptanc showing single pontoon



Curties in flight after rising from the water.

NEW THINGS IN AEBONAUTICS

or failing at a constant rate, the liquid having once adjusted itself to the correct reading, remains stationary. A velocity as small as 10 centimeters per second can easily be read.

Besides instruments that depend upon fluctuations in atmospheric pressure, sereral forms of anomometer are used to desirmine the vertical motion of the balloon with respect to the surrounding sir. If the barmetric instruments show that the balloon is naither rising nor failing, then these assummeters indicate the vertical movement of the sir itself. A combination of the barometric and anomometric methods given the bearest possible spyroach to a determination of the absolute vertical movement of the balloon.

A simple form of vertical anemometer is shown in Fig. 3. This consists of aywindwheel, mounted on a vertical axis. The direction in which the vance of the wheel revolve shows whether the instrument is rising or failing with respect to the air; ev, in case the instrument is stationary, whether the air itself has an upward or downward movement.

An ingenious modification of this instrument has been introduced by P. Lents, of Gross-Lichterfelds, Germany, who calls his device the kodophones. This is shown in Fig. 4. Here the axis of the wind-wheel is so adjusted at to ring one or the other of two bells, according to the direction in which the wheel is turning. These belie are of different tone, so that the aeronaut, who may be busy with other observations, does not need to examine the amenometer to determine whether the balloom is rising or failing. Moreover, he is instantly apprised of any change in the sound emitted the total of any change in the sound emitted by the instrument. A truiture advances of the change in the sound emitted by the instrument is faint that it is a superluly bright has by day.

that it is as useful by night as by day.

Another recent instrument, of a m pretentious character, is Ludewig's vertical anemometer.† as shown in Fig. 5. This instrument makes a continuous automatic record of the vertical movements of the balloon with respect to the air. Here the wind-wheel is very delicately mounted, within a protecting cylinder, C, so as to respond to the slightest vertical movement of the air. On the axis of this wheel there is a small hollow brass cylinder (Fig 5 s), through which six holes are punched, each pair at opposite extremities of a diam two near the top, two near the middle, and two near the bottom of the cylinder. diameters are inclined at 60 degrees to each other. This piece of apparatus is inclosed in a horizontal tube, R, at one end of which is an incandescent lamp, L (Fig. 5 b), and at the other a moving ribbon of sensitised paper. Whenever a pair of holes in the brass cylinder comes into line with the axis of the tube, the light from the lamp axis or the tube, the light from the lamp passess through, and is focused by a lens so as to make an impression upon the photographic paper. The latter is moved at a constant speed by clockwork. The character of the resulting record (see Fig. 5 c and 5 d) depends upon the direction and ed of the rotation of the wind-wheel, which in turn is dependent upon the vertical which in turn is appendent upon the vertical motion of the apparatus with respect to the air. The faster the wheel turns the more crowded will be the vertical rows of spots on the paper. This record can be starpreted numerically by means of an ap-reprinte calculation, the speed of the ribbon being known.

Curtim's Single Hydroplane Float for Assoplanes By John Fulten Great

CLENN H. QUETIES added another page Cto the history of hydroscroplaning the morning of February Jat. at San Disso, Califordia, when he flew from and allested upon the surface of Rev Disso, Say, selling overland of pages 411.

* Physikalische Zeitschrift, 9, 1908, p. 868.

Labor Saving by Automobile Power

Gasoline vs. Perspiration

By Walter Langford

erm for jifting and hauling. Tractor trucks, pulling one or more vehicles, are inchesingly employed. An 8-ton motor truck pull-trailers and hauling an aggregate load of 25 tons is being emday, from a power house to a new street which is

being filled in, as compared with half that load car-ried and half the number of trips per day by the ordinary horse-drawn truck. The coal merchant em-

the motor of the tractor, facilitates loading and unloading, and a cable and drum outfit is employed to climb slift grades.

rywhile usersiness of the automobile as a time and a labor-caving machine through its superior speed and carrying capacity as compared with horse-drawn validies is now being increased by arranging the

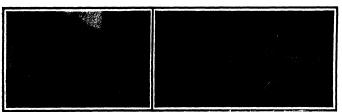
regular power plant of the vehi-cle, or a separate power equipment carried on the vehicle, to per-form special works other than the prepulsion of the vehicle. There are two general labor-saving auto mobiles, repre-sented in the accompanying views of typical applications: Machines with an equipment designed to replace the human muscle of their drivers or crews in such operations as dumpto steam-power plants and private residences, load-ing and unload-ing lumber and other materials, the operation of winches for various purposes, and pumping water, and to save time or labor by other special means: which the power ised for mechaniyoud the scope of labor, such as high-efficiency street sweeping, threshing and other farming operations, and pipe thawing by electricity.
One of the best-

stablished of these auxiliary automobile newer the powerdumping coal



Trimming are lamps from a tower wagon.

Setting a city are lamp post.



Thewing frozen water mains.

Three-ton truck with lumber hoist.



An electric truck pulling a cable.

MOW SPICIOUS DO THE WORK OF MUSCLES

ploying electric trucks has found it cheaper in labor expenses to tip out his loads of coal by a small motor under the seat, rather than to continue the old hand-crank method A remarkable application of

portable electric power is a pipethawing equip-ment consisting of a motor generator or transformer carried on livering a large current at low voltage through the "frozen-up" pipes between curb side or hydrant and water

Pumping water

out of electric subway manholes -frequently quired after heavy rainstorms or on account of breaks in water-mains—is an operation that being neatly of the more progressive electricsupply, telephone and telegraph companies p o w e r-pumping outfit carried on the "emergency the ton Electric Co has improved on the former method, of teaming to the flooded district a clums, hand pump an? two to four men to operate it, by placing a gaso pump on one of its electric trucks. company of Provi-dence, R I., has tric motor-driven pump with starting rheostat and connections, which can be placed on any of the trucks of the company and op-erated from its storage battery Another electric

is running, or pice persa The construc-tion departments of the various electric service (Continued on page \$11.)

outfit has a 225-ampere-hour battery in place of hour battery, and double-pole switch, so that the pump cannot thrown while the vehicle

Observations Among the Workshops of Europe-I

Practical Hints for the Extension of Our Machinery Trade

By Capt. G. L. Carden, U. S. Revenue Cutter Service

[The value of the Europeon market as an astlet for American thate has inversant repidity during the post free power. With a relate to assertation, renditions in the machinery trade, the United States government recently sent Ough trade, the United States government recently sent Ough trade, the establishments, by and diffice, which are on-aportis the manufacture of machinery Ough Carden finds that there are prest opportunities open to American trade, purituisity in the apport of those machine tools in which purituisity is the apport of those machine tools in which we do not the world. The full proposed review of the machine tools in which we do not the world. The full proposed control with the control of the machine value of the proposed on the Contracts. EMITON, 1

T HE possibilities of the foreign market, especially in recent years, have not, it is eafe to say, been fully appreciated by the majority of American m chine tool builders. This is the natural outcome of the enormous demands at home. There has been little incentive to study over-sea conditions, and not only has the question of foreign business been underestimated generally, but the capabilities of foreign

machine tool builders have not been fully perceived.
Generally speaking, the best grades of American machine tools excel both in design and workmanship the foreign built tools. There are a number of foreign shops, however, which are approaching very closely to American standards; but, as a rule, the great majerity of the European machinery houses are far be low American works in point of shop efficiency and cost of production. The Germans have fine shop organization, but lack sufficient territory to permit of specializing. Their country is too circumscribed to make it possible for a new firm to hope to live on the domestic trade. Export business is, therefore, the life of the nation, and the best thought and energy are directed to the interest of foreign commerce.

When one considers industrial Europe of to-day we are apt to think largely of Germany. The industries in that country are indeed extensive, but there are other sections in Europe in which enormous progress has been made in the past few years, and is still in the making I refer especially to Northern Italy, Bohemia, Hungary, Poland and the districts in Russia lying more especially in and about St. Petersburg and Moscow. The Milan and Turin sections of Northern Italy are the centers of rapidly growing manufactur-ing districts. The superb climate, the available electric power from the Alps, the efficient railway con-nections and the shipping facilities at Genoa all serve to enhance the manufacturing advantages of Northern The North Italian machinist has no superior on the Continent, he is naturally apt and soon be-comes an expert man. There is no finer work turned out in the world than is in evidence in some of the Italian machinery shops. Large exportations of man machine tools during the past two years have been made to Austria-Hungary. That statement alone will indicate the manufacturing activity there It would seem as though the possibilities of Austria-Hungary are only commencing, and in Hungary particularly there is an enthusiasm manifested, such as

one would rather expect to find in a new country and among a young community
In France in 1908, during a period when many

American shops were closed down, manufacturing domands were so great that the French found it necessary to call upon foreign firms to build many of their locomotives. The French locomotive shops are among the best in the world, but they were not equal to the extraordinary demands made for railway equipment during the year mentioned, and in that period French ocomotives were built not only in Germany but in Bohemia and Italy. One order for thirty-five locomo-tives was secured by the American Locomotive Works.

In general lines of machinery the standards in Eu to-day are higher than in America. This statement applies particularly with reference to steam engines. Take for example the works of Carels Bros. of Ghent, Belgium This firm builds engines varying from 400 to 5,000 horse-power, suitable especially for mills, electric power stations, and similar installatio electric power stations, and similar installations. It is the pride of this firm that it makes a specialty of engines required to run continuously, without a stop, for, say, three months. The Carels guarantee for their super-heated steam engines a consumption of only 8% pounds per indicated horse-power for triple expansion engines. What the Carels are doing is equated by other firms in Europe. Suizer Bros. of Winterthur, Switzerland, and Franco Tosi of Legnago. Italy, are also building superb engines, and the fluish and workmanship on Continental engines generally are extremely fine. There is little hope for competition with the European engine builder of to-day except with engines possessing more economical features and giving evidence of superior workmanship.

The essential difference between European and American shops lies largely in manufacturing methods For the most part, European works are building diversified lines. The principal machine tool builders are confining their attention wholly to machine tools, but even these firms find it necessary to build diversified lines of machines. This is directly opposed to the best practice in the United States, where we find shops confining their attention almost exclusively to

The strongest competitors in the United Kingdom to-day of American machine tool builders are such firms as Herbert of Coventry, Darling & Sellers of Keighley, Kendall & Gent of Manchester, Richards of Broadheath and Lang of Johnstone. Lang, for example, is confining his attention almost exclusively to This statement is true of Darling & Sellers. Herbert is manufacturing a number of types of ma-chines His reputation is largely founded on a very few designs of machines. The Darling & Sellers shops at Keighley are small in extent, but the workmanship on their lathes is not excelled in Europe. It is a fact that a Darling & Sellers lathe fetches £30 more than some of our standard American lathes of the same size. The Keighley firm, however, is content to

limit its output to a comparatively small number of nines per year

The greatest need abroad for the proper exploits tion of American machine tools is expert operators. In one of the big electrical houses in Switzerland, where a superintendent had been taken on, having had American experience and who understood Amer ican machine tools, it was found possible to reduce the cost of machine work on a certain make of pul-leys from 3 france each to 60 centimes. This demonstration was effected through the use of an American turret lathe. Previously, the work had been performed by an ordinary lathe.

As a rule, however, there is little, if any, direc representation from American firms in Switzerland, and the statement was made that there is only an occasional American caller at the works. Generally speaking, the sale of American machine tools abroad has been left to foreign agencies. There is no better market in Europe to-day for American shop equipment than in Switzerland. Swiss engine work is not excelled in Europe.

To understand properly Swiss industrial conditions it must be understood that Switzerland produces no coal and no iron ore. For the manufacture of ma-chinery raw material is brought in, for the most part, from Germany; the latter country also supplies the greater part of the coal which is used. It is als fact that some of the Swiss firms are paving less for their coal than is charged in Germany, according to the statements made by reputable officials. The iron ore is, for the most part, brought up to Mannheim on harves and then is train-hauled into Switzerland. of river service, the cost of transportation often inuses from 25 per cent to 30 per cent.

Zurich is the center of industrial Switserland. Within a comparatively short radius are the great electrical houses of Oerlikon and Brown, Bover! Co., the machinery works of Escher, Wyss & Co., the Swiss Machine Tool Works, Sulzer Bros. and the Swiss Locomotive and Machine Works,

While Switzerland is lacking in iron and coal, the country can boast of an enormous amount of wa Handicapped as the Swiss are for want of ore, they are able to maintain their position in the outside world only through superior technical knowledge, and in this knowledge they have much to thank their engineering institutions.

I found that the majority of the workmen are paid less in Switzerland than in the Berlin territory, but better than in the Chemnitz shops of Germany. conditions in Switzerland are in a somewhat unsetcondutions in Switzerland are in a somewhat unner-tied condition; there appears to be a great deal of drifting on the part of the workmen, and I was in-formed, in the case of one shop, that the beginning of each month finds about 50 per cent new men. As a rule, however, the percentage is from 20 to 25.

(To be continued.)

The Pan-American Commercial Congress

DURING the week beginning February 13th, there was in session at Washington a very interesting congress known as the Pan American Commer-cial Congress. The place of meeting was the new building of the Pan American Union, which is a handsome structure of modified Spanish architecture and one of the capital city's show buildings Di-rector General John Barrett, who is the prime mover in this congress, succeeded in procuring a list of notable speakers, prominent among whom were President Taft, the Secretary of State, Senator Root resentative 'hamp Clark, and many members of the Diplomatic Corps. The purpose of this congress was to consider informally the opportunities for extending trade conditions in the twenty Latin-American countries for the manufactured and natural products of the United States, and reciprocally the market in the United States for the products of Latin America The discussions were illustrated with maps and other exhibits, and the proceedings were purely educational and informative, and controversifit only east they involved exchanges of opinion as to practical business methods, expressions of political views being strictly tahoned

The Commercial Congress is the harbinger of the opening of the Panama Canal, when it is anticipated that the entire trade aspect of that part of the globe will be charged.

A subject of importance which was considered by

the congress was that of "Trade-Marks," which is just now attracting a good deal of attention owing to the fact that it was a topic of serious consideration at the Fourth International Conference of American States, which was held in Buenos Aires last summer

A Menace to the Alfalfa Crop

I N 1904 the entomologists of the Utah Agricultural Experiment Station discovered a weevil in an alfalfa field near Salt Lake City, which had not been known in this country before that time. Since then this insect (Phytonomus murinus) has spread in all directions over a large territory and threatens to extend its ravages throughout the alfalfa country

At a recent meeting of the Biological Society of Washington, Francis M. Webster, of the United States Washington, Francis M. Webster, of the United States Department of Agriculture, gave an account of the life history of the breste and of its methods of diffi-sion. The eggs are laid in the young steeps of the alfalfa plants, and as soon as the grub hatches out if climbs to the growing tip and feed; on the tendent leaves, preventing the growth, of the plant. As the, eason advances, the shull bettles are found freeling: on the plants, grawing through the bark and kills them. It is estimated that the damage done by this beeste in Utah during the past season amounts to half a million dollars.

The adults conceal themselves in baled hay, in p ing material and cases, in cracks of freight cars, etc., so that they are being carried rapidly in all directions

by the regular channels of commerce. In addition to this the flying adults are readily carried about by the winds. No means have been found for fighting this new enemy of one of the most important of our crons Frogs and toads seem to be the only natural en in this country, and these cannot be relied on to be in this country, and these cannot be relied on to be of much assistance in the comparatively for regions where the attaints is raised. The birds do not seem to relish them, and, no insect enemies have been found. The larves of similar forms in the Bastern States have been successfully comband by means of certain-tangt; but these do not seem to attack the larve of the Inserts executive. of the lucerne weevil.

The seriousness of this new danger may be realised when it is considered that in several of the Western States the alfaifs crop-means the farmers' chief or even sole source of cash. The cultivation of signife over accessores or ossen. The cultivation of sitelite has developed so rapidity that the government statisticians have been quable to determine its value from your to year with any degree of accuracy. For 1995 the value of Ahi crop was settimated by the experts as being, over \$100,000,000.

Assenjagical Observations in Nebreaks
This Wasther, horsen, het undertaken a series of
the continguations resents at Consist, Note, extending over the sprint Potency (to be March tell in-clusive, during which time daily seconds with he mode.
The results will be published in the bulletin of the
Mt. Westher Observatory.

Carrespondence

"Volator" and "Volation" for "Aviator" and "Aviation"

To the Editor of the Scientific American:

By reference to the Standard Dictionary (Funk & Weignaffley, you will see that the Brockin Moraing Johnstal (July 2nd, 1831, page 1, column 6) introduced the word "sviater" into the English language. The same authority shows that "aviation" was

duoid the word "aviator" into the English language.
The same authority shows that "aviation" was coused by the Somewise Arrangan Supplement, February Shi, 1890, page 12754.

Bath these are good words, but they are used so often by 'assesper reporters and head writers that residers bag for a change. These two journals, truit ful in supplying words, may do a service to humanity progneting yrongyms, manty, 'wolator' for 'avistor,' and 'wolaton' and 'wolaton' and are sanctioned by lexicographers. It would be a great relief a have something new. What do you say, gentlemen? Will you help?

Wells Dauxy.

Berkeley, Old.

perkeey, Cal.
[We regret that we cannot concur with our correspondent in his suggested use of "volator" and "volation" as synonyms for "aviator" and "aviation." There would be confusion with the word "volition" (Latin colo, to will).—Enrows]

Non-inflammable Gas for Digigibles

To the Bditor of the Scientific Assistant.
After reading a review of the accidents that have occurred during the past year to the birdmen and to the receiver of the series of the serie

lighter than sir. This might be accomplished by working on hydrogen, and combining it with another gas
or gases, thus to a certain extent denaturing it, yet
retaining sufficient of its buoyancy to make it practical
for servasuation purposes. I believe that the discovery of such a gas would be the assuring of the
commercial 'uccess of the dirightle. True, the matter
might prove a chimera, but I believe, if searched for
in a systematic manner, it would be discovered.

Lolita, Tex C. S MITCHELL.

A Phenomenon of Static Electricity

To the Editor of the SCIENTIFIC AMERICAN

A peculiar effect happened in February, 1909, in the forge shop of the Louisville Manual Training High School It was supposed to have been due to static electricity. A plate of hard steel about ½ by 2 by 6



inches was being ground at the emery wheel. As the belt was twisted, it was rubbing together about 18 inches above the wheel One end of the plece was dipped into some oil at hand, to cool it, and was then being returned to the front of the wheel, we at one end. It was held in the right hand. When the plate was distant about 10 inches from the belt, thy streams of oil left the nearest edges of the plate, going toward the belt. They were deflected downward as a curve, possibly by the wind caused by the belt hand interposed between the belt and plate caused the action to cease. This effect of the oil streams is not known to have occurred before this, but everyone knows that when one's hand is held a short distance knows that when one's hand is held a short distance

from such a twisted belt, sparks leave the tips of the fingers, provided no one is touching the emery wheel or the rest if the other hand is then held between the first and the belt, no sparks will leap across the air gap

Lexington, Ky Herbert A. Kohnhornt

Stereoscopic Effects of Solar Photographs

To the Editor of the SCHENTER ANTHRIAN
In examining the Illustrations used by Mr. Wade
with his article "What Are Sun Spois": I was much
interested in using the stereoscopic effect of the eyes
on different pairs of the pletures, particularly of the
six pletures to the left of the telescope picture on
gape 400, SCHENTER ANDERSA, dated November 19th,
1910 I thought perhaps your readers might be intereated viewing the craters in this way (or by mounting on cards and using a stereoscope). The light
'cloude' seem to be floating near the craters and thu

Wichita, Kan Guy H Wins This letter was submitted to Mr Frederick Slocum,

craters seem very deep

the Yerkes Observatory, who replies "There is nothing especially novel in the application of stereoscopy to solar photographs tion of stereoscopy to solar photographs. We have frequently used the stereo-comparator here for that purpose I do not recall that any stereo-pictures of the sun have been published. Very little scientific importance is placed upon the stereoscopic effects seen in photographs, for both Prof. Barnard and Max Wolf e shown that various effects can be produced by combining the pictures in different ways. In regard the pictures in the Scientific American, the calclum clouds are, of course, floating above the spots. That is clearly shown in the picture taken at different levels on the right-hand side of your illustration on page 400, but whether they can be made to stand out stereoscopically, I am not so sure Mr Barnard, who as you know, has a remarkable power of stereoscopic vision, fails to get any perspective from the pictures as printed in your paper. I have tried some larger prints in a stereoscope, but get only fictitious perspective, due probably to a slight jarring of the tele scope or to a slight irregularity in the running of the mechanism of the spectrohellograph"

Uncovering the "Maine"

I N a recent issue we gave an illustrated description of the plan adopted by the United States Army Engineers for uncovering the United States ship "Matine," so as to render it possible to make a carril examination of the condition of the worked portion of the bull and sixeover the actual cause which sent her to the bottom.

The disastrous explosion, whether it was due to the detonation of a mine placed beneath the ship, or to the spontaneous explosion of the contents of the forward magazine, or whether it was flue to a combination of both, blew out the sides and deck of the ship, and, except for some connecting bottom plating, practically cut the vessel in two at about one-third of her length from the bow. The heavy bow, with its massive ram, sank first, bending downward so that the ram sank deeply into the mud Then the after portion of the ship settled, leaving the vessel in 37 feet of water, with only the wreck of the super-structure and one mast standing exposed above the surface. The siern settled in the mud to a depth of 8 to 10 feet, the bow very much desper

Among the many plans submitted for recovering the vessel were several which contemplated lifting the wreek to the surface by means of heavy hydraulic gear and tackle. These were all rejected on the

BARNING PASS

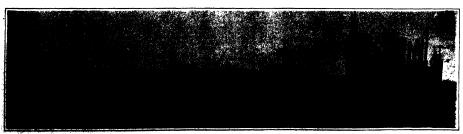
ground that the vessel was so badly broken up, that to lift it bodily would be to further twist and displace the wecked portion of the ship, and so destroy its value as evidence in determining whether the explosion was from within or from without

With a view to making an examination of the vestel in sits, the e.g.hineers have planned to build entirely around the wreck a huge watertight wall, pump out the water, leaving the bottom mud exposed, and then dredge away the mud from around the buil, leaving the latter entirely exposed for examination

The cofferdam wall, which will be elliptical in the cofferdam wall, which will be elliptical pillins, driven for a series of fifty-foot aterphilis, driven for into the firm bottom some 70 feet below the surface. The joints between the serveral confordams will be made watertight by driving a segmental wall of the pilling between each pair. As the cofferdams are completed, they will be filled in the confordam will be written to the with a part of the complete of the complete

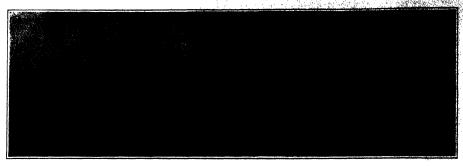
In order to further strengthen the cofferdam, it is plaumed to use rock from an old tunnel dump for backfilling along the interior face of the coffeedam at its base. When this has been done, the mud will be scraped away from the hull and drawn over toward the cofferdam wall, by means of drag buckets

The work of driving the steel piling is rendered difficult by the fact that the bottom of Havana harhor is strewn with the accumulated wrecks and rubbish of sant venturies. The scene of the salvage operation is one of great activity, as will be evident from a study of the accompanying photocraph, which was recently taken in Havana harbor. In the center of the picture is seen the wreck of the abil. Beyond the main mass is seen a seen pile-driver engaged in driving one of the circular cofferdams, the wall of which is nearly completed On the extreme right is a completed cofferdam, which shows clearly the character of the interlocking piling of which the wall is built. To the left is a partially completed cofferdam, and within it will be notified the floating template, or form, which acts as a guide in putting down the piling. Congress has appropriated \$300,000 for this work, and the preliminary estimate of the engineer



is the state of the struct. To the right is me of the dreular, steel-pile cofferdam. To the left is a part of a caffordam and a pile driver putting down steel piling.

GENERAL VIEW OF THE "MAINE" BALVAGE OPERATIONS



UNCLE SAM'S new Bureau of Mines is doing battle with many unseen and unknown dangers that lurk in the bowels of the earth to claim the lives of the men reaping the mineral harvests of this country, but none of its investigations are as important as its efforts to overcome the ignorance of these people concerning the dangers which encompass them in their daily toil For much of the havoc among miners is due to lack of knowledge of the explosive powers of coal dust and fire-damp and to incompetence in select ing safe explosives for the blasts. Many of the miners seems to have no conception of the importance of a really safe "safety lamp," for often they purchase a dangerous substitute merely to save a few cents, thereby endangering not only their own life, but also that of hundreds of others. So Uncle Sam is establishing free schools to enlighten them. Pittsburg, Pa., in the very heart of the coal regions, is the first of these new schools, but it is hoped that others will be opened shortly; one at Raton, N. M. for inhabitants of New Mexico, Colorado, and south ern Utah, Wyoming and Nevada; another at Salt Lake City, for the central Utah fields and accessible to Montana and Washington, and a third near South McAlester, Okla, to take care of the coal miners of Oklahoma, Arkansas, southwestern Missouri and southeastern Kansas

Sham mine explosions are created for the instruction of miners attending the school. The apparatus provided for this purpose is an explosive gallery—s great horisontal tube of boller plate 100 feet long and wide enough for a man to walk through it without striking his bend against the ceilling. Across the open end of this tube is placed a drumbead of heavy paper and the inside is then filled with fire-damp or coad dust which electric fans thoroughly mix with air until they are of the consistency in which they are ordinarily found in a mine. The drumbead keeps the gas or dusty air from escaping, and at the other end of the big cylinder, but sixty feet away is the observation, house. A long peep hole extends along the rear wall of this house, and a row of miners line up inside with their faces to it. Plate glass a half inch thick protects their eyes, and a shield outside the building is so directed that the vision of the mes is directly on



Apparatus for testing safety lamps under varying conditions of gas and coal dust.

big tube is a twelve-foot cube of reinforced concrete holding a mortar aimed right down the tube and loaded with one of the explosives commonly used in mines. A wire connects this mortar with a key from which it is fired at a distance, and parallel with the

a line with the long cylinder stretched along the ground.

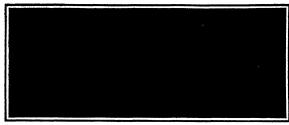
With the pressing of a button the mortar is fired and the coal dust, or fire-damp, in the gallery explodes There are sixteen port hol the side of the cylinder, and the miners are told to note by these how the blaze of the explosion progresses along the tube from the mortar to that covered with the paper drumhead. The explosion, of course, blows the paper out, and at the same time sixteen iron doors over a row of as many openings along the top of the cylinder fly up on their hinges. These doors and the drumbead save the entire plant, of course, from being totally wrecked by the explosion. As it is smoke pours out of the tube and there is a loud detonation. This test gives many miners their first demonstration of the fact that coal dust is highly explosive and teaches them much that they should know about the explosiveness of firedamp. At the same time the apparatus demonstrates the compara-tive safety of different explosives purposely used as Charges of dynamite, black powder, and vari-"safety explosives" are fired off from the mortar in the presence of coal dust and fire damp for the miners to watch their comparative effects and learn the strength of the charge of each that can be used without danger of an explosion. It is the aim of the new bureau of mines to standardise mine explosives, and it hopes in time to have only those used all over the country which these tests prove are comparatively



HOW THE GOVERNMENT IS TEACHING THE MINERS TO SAVE TRIMERLY IS

that "melet" kmp" is often a missomer or a trade mans. The superatus used to illustrate this lesson in a way in the superatus used to illustrate this lesson in a way in the superatus used to illustrate this lesson in a superature that the superatus is the subset of the subset being the superatus in the subset of which is superatus in the subset is superatus in the subset is subset in the subset in the subset is subset in the subset in the subset is subset in the subset in the subset is a Washaped box with supposition from the properly constructed safety being. Below the main tube is a Washaped box with supposition of the subset in the subset is a Washaped box with supposition of the subset is a washaped box with supposition of the subset is subset in the subset is a washaped box with supposition of the subset is subset in the subset is subset in the subset in the subset in the subset is subset in the subset in the subset is subset in the subset in the subset is subset in the subset in the subset in the subset is subset in the subset

As accordents will cappen notwithstanding all efforts to prevent them, the miners are taught in a mignic shall mike what to do in dread times of first and explosions. This is a faring giass-incased air-tight riposis which contains difficult passages, such as exist in cost mines. There are also various obstructions simpliar to those found in a disrupted mine. Dummies may provided, weighing from 180 to 100 pounds each, riposescepting applicated miners. This room is actually filled with sulphur gas, and the rescue corps of men who are being trained in the work enter daily, wearing oxygen helmets, and remain two hours re-



The rescue car of the Bureau of Mines.

who toll underground. The life-sustaining breath is in the form of compressed oxygen stored in a cylinder which is carried on the back, the oxygen being connected with the operator's mouth by a flexible, rubgen, together with more oxygen from the cylinder, is again available for the operator

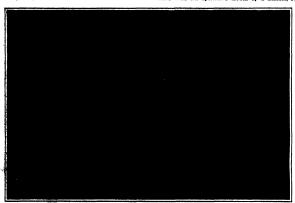
How eight to ten thousand of our minera are now being killed and injuree every year, has been told over and over in our papers and magazines. This annual have equals the mowing down of ten to a dozen regiments of soldlers. In the years, more than a regiment has been killed outright in the Pennsylvania coal mines alone. During the past twenty years these black coal mines of our have killed 30,000 men, made 11,000 widows and 20,000 orphans. It seems time for the government to make strenuous of forts to overcome the ignorance which caused most of

Wanderings of Ulysses

ULYSSES did not only wander in the Homeric modern prix, but wandered considerably in the theories of modern archaeologists. The idea that the little rocky isie that proclaimed its identity with ancient thace was the city of Ulysseva saliegiance, was not attacked definitely until 1903. Then Dr. Doerpfeld, director of the German Archaeological inlatitue at Athena, advanced reasons for regarding Leucadia as the city of Ulyssea. A few weeks ago Dr. Cawadias, of the University of Athons, advanced a new theory based upon recent excavations. He selects the ionism island of Cephalonia for the honor, basing his claim on the hundred Mycenseun cumbs discovered there.

Paper Sensitive to Ultra-Violet Rays

M OST photographic papers are affected only by multipour rays and ultra-violet rays a little beyond the limit of visibility. A paper which is especially sensitive to ultra-violet rays has lately been produced. It is prepared with nitrite of paraphenylean-diamine and turns blue when exposed to ultra-violet



Mine renouers at practice work. Passages and obstructions are supposed to represent conditions found after mine explosion.

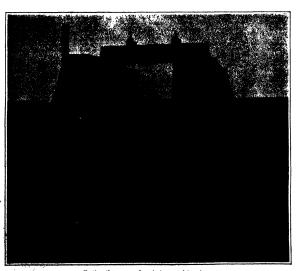
moving obstructions, picking up dummies, giving them amergency treatment, placing them on stretchers, and carrying them away.

carrying turns wave. In addition to these local schools a number of traveling schools or mine rescue cars are sngaged in spreading the knowledge that saves lives. These cars are
fitted up with all kinds of life saving apparatus, and
carry an instructing corps of practical miners trained
in rescue work. These schools go to the miner in the
own comp or town and stay long to register the
place to thoroughly advise to the miner in the
place to thoroughly advise to the miner in the
place to thoroughly advise to the miner in the
place to thoroughly advise to the miner in the
place to the control of the stay of the
supportions which occur in the mines. Each of the six
cars which the government propose to have on the
road in a short time will have a certain territory to
cover, but the headquarters of each will be as follows:
Car No. 1, Pittaburg, Pa; car No. 2, Urbana III; car
No. 5, Rock Springs, Wpo; car No. 4, Billings, Monti:
car No. 6, Salt Leke City, Utah; car No. 6, Knoxville,
Tenn.

Bach car yill be manned with a mining engineer, a surgeon of the American Red Cross Society, and assistants who have been minors themselves. Historiacle lectures and moving picture shows will be given on the use of explosives; how to prevent fire in mines, the proper ventilation of the mines and first-aid surgical treatment. Each of these cars will contain a number of oxygen helmets, a supply of oxygen in balks, a doesn astery issue, a field telephone with halks, a doesn astery issue, a field telephone with \$,900, bet of wire, several life-saving outfits, and a small-outfit for use in teaching the miners the principles of first sid to the injured. One end of the car is with 50 mines with the side of the cargo o

(ii) the way the nineer see of he made theroughly seed with the one of the belings. In the person with the believe believe, so more and the common way about ones in the reasons of the most

ber-lined, metallic tube. The exhalations are passed through small lumps of potassium hydroxide, which absorbs the carbonic acid gas, after which the nitro



Tusting the power of explosives used in mines.

NOW THE GOVERNMENT IS TRACEING THE MINERS TO SAVE THEMSELVES

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Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

Experimental Mechanics

TIMES have changed. Engineering has become so much of a great lady as to compel the respectful attitude of mathematics, and to make her connection with trade rather a recommendation than otherwise. In other words, the world must have engineers, engineers must have mathematics, and, therefore, mathematics has become more practical. Moreover, in the engineering profession itself the problems which require solution become more and more of a kinetic nature. The strains and stresses in girders and ombankments are as important as ever, but, in addition, the mechanics of movement is growing in importance We move faster nowadays, not only on the railways, but on the roads, in the water, and even in the air Hence it is that the practical teaching of mechanics, which used to be limited to a few experiments with spring balances and pulleys, has now spread into the region of kinetics. The concepts of force and work are undoubtedly best approached by practical measurements of the efficiency of simple or plex machines, and it has been found that velocity, acceleration, kinetic energy, moment of momentum, and other concepts involving movement can best be realized in a practical manner

In a striking article published in Knowledge, Mr. W. D. Eggar points out concretely the relation between the sciences of experimental mechanics, engineering and metrology

"The measurement of time," he begins, "has always been a difficulty in the way of those to teach kinetics by experiment. Electric chronographs are expensive, and even where expense is no bar, they are frequently found wanting either in their working or in their power of elucidating the problems in which they are employed. A recent adaptation of the old tuning fork method of measuring time has revolutionized schools of dynamics The tuning-fork meth od will be best understood from a glance at Fig 1. which shows an arrangement for allowing a pla glass to fall so as always to be in contact with a attached to one prong of a tuning-fork vibrating with known frequency. A wavy curve is traced on the glass by the vibrating point, and the space fallen in a given time can be determined by measuring the length of that portion of the wavy curve which contains a number of waves corresponding to the given time. Another apparatus for measuring the velocity of the rim of a flywheel by means of a tuning-fork is shown in Fig. 2 Now a tuning-fork is not very easy to manipulate, and it goes rather too fast for beginners. Here it is that a great simplification has been made by Mr W C. Fletcher. A strip of steel clamped at one and carries a paint brush at the other end. A long trolley carrying a strip of paper moves underneath this paint brush in the direction of the steel rod's Suppose the steel to vibrate ten times a se ond, then the paint brush will trace a wavy line on the paper, and ten waves wn represent the distance travelled in one second. The lengths of the waves give velocities, and the changes in the wave lengths give the accelerations . Fig. 3 gives an example of the way in which Fietcher's trolley, may be employed for measuring the acceleration when the trolley is allowed to run down an incline One of the curve tracings made by the paint brushus allown resting by the side of the plane. As for the way in which the ac-celeration is determined from a curve of this kind, let un consider the curve shown in Fig. 4 Placing s centimeter scale along its wave creats, we can read the distances of these crests from the starting point of the curve to the nearest half millimeter, thus 0.1, 0.8. 145, 225, 3.2, 435, 565, 71, 8.7 10.5, 12.4, 14.5, 16.75 From this, by subtraction, we obtain the successive wavelengths, viz 0.25, 0.45, 0.65, 0.8, 0 95, 1.15, 1.3, 1 45, 1 6, 1.8, 1 9, 2 1 2 25. It is obvious from this that the wave-length has been increas ing fairly uniformly the successive increments in we length being again obtained by substraction. Thus they are 0.2, 0.2, 0.15, 0.15, 0.2, 0.15, 0.15, 0.15, 0.16, 0.2, 0.11, 0.2, 0.15. The average of all these is 0.167. v, since the wave-lengths correspond to periods of one-fifth second, it is plain that the average incres in the space travelled in each one-fifth second is in-creasing at the rate of 0.167 centimeter in every onefifth second. Hence in each second the increase in the velocity is 5×0.167 centimeter per one-fifth second, or $5 \times 5 \times 0.167$ centimaters per second. The acceleration is therefore 4.17 centimeters per second.

As an example of the way in which the apparatus may be employed we may take the verification of

the law "Acceleration is proportional to the accelerating force." The variable force is obtained by varification slope of the plane. To avoid having to consider the force of friction, the troiley is first connected by a string passing over a pulley, shown in the figure, to a scale pan of known mass, and weights are added just enough to prevent the troiley from acceleration.

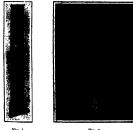


Fig. 1. Fig. 2.

Fig. 1. -Apparatus for measuring time with a tuning fork.

Fig. 2 - Measuring the velocity of the rim of a wheel.



Fig. 3.—Firstcher's trolley for measuring acceleration.

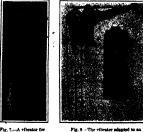
Fig. 4 - Wayy corresponding acceleration



Fig. 5.—Two trolleys for verifying the laws of momentum and impact



Fig. 6 -An inertia bar set in motion by a trolley



easnring the angular

Atwood's machine in which a paper ribbou replaces the string

waves made by the paint brush are of equal length the total force down the plane is exactly balanced by the scale pan and weights. Now if the string is removed the trellay will accelerate under a force which is equal and opposite to that which hap-been remisved, vis., the weight of the scale pan and its contents. The acceleration can be unasured as before. If this observations are now repeated with a different single- of elope the two accelerations will be found to be in the same ratio as the two accelerating forces. Als appreci-

NEW EXPERIMENTAL APPARATUS.

mate verification of Newton's Second Law may seem unsatisfactory; but the method has the merit of making the notion of acceleration much more easy for the ordinary mind to greep.

Fig. 5 shows how by means of two of these trolleys, laws of momentum and impact may be well-fied. In one form of the apparatus, employed by Mr. Ashford, at Dartmouth Naval College, one trolley carries a pistol and the other a target in which the bullet embeds itself. After the shot the trolleys retire with equal moments.

Fig. 6 shows an inertia bar, which is set in ro-Fig. 6 shows an inertia bar, which is set in ro-

Fig. 6 shows an inertia bar, which is set in rotation by the impact of a troiley. Vibrating speings are employed as before to measure the momentum of the troiley, and the angular momentum of the bar. Fig. 7 shows the vibrator employed in measuring

Fig. 7 shows the vibrator employed in measuring the angular valuoity of a fly wheel. The netion of kinstic energy becomes clearer after a series of measurements taken with an apparatus of this kind. Mr. G. Cussons, of Manchester, to whom we are

Mr. G. Cussons, of Manchester, to whom we are indebted for the photographs used in illustrating this article, has adapted the vibrator to a form of Axwood's machine in which a paper ribbon replaces the usual string. The apparatus is shown in Fig. 8. Excellent results are obtained from this instrument, and Fig. 4 is a reproduction of one of the curvesobtained from it.

Self-luminous Matter

A BOUT the year 1800 Vincenzio Casciorole, a shoemaker of Bologna who dabbed in sichemy, discovered that heavy spar, or barium sulphats, which had been fused with other substances, emitted in cooling a blue light, which gradeally became fainter, but increased in brightness when the mass was exposed to sunshine and then brought into a dark room, as if it absorbed and then poured forth the solar radiation. With the assistance of two local scientists, Casciorole manufactured many of these lightnesses, stones, which were sold at living Europe might the name of Bologna stones or Bologs stones, and which verrywhere created great assistations.

name or sologia stones or seesons stones, and whose verywhere or created great asymptomic or control of the property of "phosphoricotope" is possessed, to some degrees by many subscapies, and very strongly by certain sulphides Masses which exhibit beautiful voilet, green, red, and yellow phosphorescence can be produced by heating the sulphates of the "alkaline earth metals," bearium, stronitum, and calcium, with minute quantities of sulphates of copper, bismuth, sinc, and other metals, together with deoxidizing agents, which reduce the sulphates to sulphides. The phosphorescence is excited most strongly by exposure to ultra-violet rays.

In commenting upon these phenomena, a writer in Recolons Hustorium remarks that there are other substances which, during their expoure to light, entit light which differs in color, or wave-length, from that which falls upon them. This phenomenon is colled Sucrescence. It is distinguished from phosphorescence by the peculiarity that it ceases the instant the illumination is withdrawn.

Phosphorescence and fluorescence have been studied very attentively, but their real nature is not yet thoroughly understood.

Phomphorescence of another sort is exhibited by many substances, and especially by the element phosphorus. Here the light is produced by a chemical process, a slow oxidation. The light of the glewworm, the firedy, and the countless minute phosphorscent organisms of the sea is due to a similar cause. The shining of the eres of many animals at night, however, is probably caused by reflection of stray rays of light from without.

Decaying wood and other vegetable and animal matter, and fish and pork even while apparently fresh, are often luminous in the dark. This light is produced by microscepic organisms called luminous bacteria.

Phosphoresome is sometimes evoked by mechanical action. Sugar and many other substances emit light when they are crushed or broken in the delt. Finally, tight may be produced by corputallisation. When areanic crystallises from a solution, the inclusion of each crystal is accompanied by a "Sank it lights".

Finally, (1971 may be processed by crystallization, when associate, or crystallization or a salution, the Specialization of each crystal is successful to the original of the Specialization of each crystal is successful; possess if sime practical distress. Aftenopera constraining tribudy of cuploins outpittled are semigroup to make mystal scales, the Sinkh of veglotes and colories, and other adjector, vigible is expected to the semigroup of the semigroup of the semigroup of the physical scales. The phosphoresement of qualityphorum is 'estimated,' the semigroup of the semigroup of the physicalization,' the contents of the missions of the semigroup of the semigrou

in a given record and receiver. If phosphorus is present a luminous ring of condensed phosphorus appears, in darkness, on the inside of the cooled receiver.

"The 'must important scientific applications of phospherisonous and florousefone are in the new field of relificability. Resulten rays and the rays emitted by relificability. Resulten rays and the rays emitted by relification policies produce luminacemone in line blende, barism platino-cyanide, and other substances, and thus the presence of these rays can be described. The function with barium platino-cyanide. The particles which constitutes the alpha rays of radium, and which are withmaskly transformed into atoms of helium, produce little polats of light when they strike a screen coated with since binde. Each bright point represents one alpha particle. In this way the existence of a single store was first demonstrated to the eye.

Hydraulic Flight

QUETLY at work since 1905, a clever Italian enceeded in producing a remarkable craft. It is a hydroplane on quite new lines, and is now being thoroughty tested on Lake Magriore.

The inventor has furnished The Car with the following:

"The apparatus has been patented under the name of "Appareecio Idrovolante" (Apparatus for Hydpareelpaining). In fact, it constitutes true hydraulic flight, the apparatus being sustained by the water in the same manner that birds and seroplanes are sustained in the air; that is to say, by the dynamic reaction of the water on the superfictes or planes attached to the hull of the hydroglane, most of these planes



HYDRAULIC FLIGHT: SIGNOR FORLANINI'S REMARKABLE HYDROPLANE

remaining completely out of the water while the machine is in action.

The idea of using the dynamical reaction of the water is not new, but up to the present has not been applied with aucess, except what has been attempted with silding boats; in these boats, low-ver, the hull does not leave the water, but skims on the surface, which hinders the attainment of really high speeds.

"The most important characteristic of the Profropiane is that the resistance of the water is not dependent on the speed, but remains constant, and is equal to half the total weight of the apparatus; the total resistance is increased only by a portion is consistance due to the air, a portion naturally proparation of the speed. In consequence, is introduced in the tuture should be able to take speed of the total peeds and change themselves into flying machines by the addition."

After six years of especimenting, line, Forlamini can mow bousider that he has arrived at fully satisfactory and deshuic results. The first hydroplane he tried ring, the years 1905, 1906, and 1907, immediately the state of the new system, but he excellence of the new system, but he considered by the state of the sta

The indeopiane that we many tested at present weight that he when there are two persons aboard to it seems to serve to persons and is the carry topy attempt persons—and is the server to the server to the person to the server t

fications that are being gradually indicated during the trials it is now undergoine, This hydropiane has a hull 32.8 feet long; at the bows and stern are understood two strong steel tubes, about 11½ feet long, fixed containing the state of planes, one above the other. A glance at our lilustration will more clearly explain the nature of these frames or grids, which somewhat resemble large women and the state of the s

When the hydroplane is not working, but is feating on the water like any other ordinary beat, the planes are immersed in the water and have a slight horizontal inclination. Immediately the hydroplane, owing to the working of the screw begins to move forward, the water exceedes a vertical force on the planes in precisely the same manner as the sir on the planes on a scroplane; the hull, therefore, tends to rise and so diminishes its immersion and naturally the resistance against its motion, in a manner that the speed is able to increase. In this way there comes a moment when the hull its completely out of the water. At this point the speed rapidly increases, and little by little he various planes or superficient rise out of the water out after the other. When the maximum speed is greached, only the bottom planes romain on the water, while the bottom of the hull is sixty-five centimeters hugher.

The propeller by which this strange craft is driven is carried on a hollow fin which may be seen amidahips, the short propeller-shaft being revolved by bevel gears attached to a vertical, intermediate shaft, driven direct

off the motor.

Although the Illustration shows the hydroplane speeding along in smooth water, it must not be inferred that it can be used only under these contidions, as a matter of fact, it has been tested when quite a 'sh wind has been blowing, accompanied by the type of short waves one gets in sheltered waters, and with perfect success. It is also stated to steer very well, and to be able to turn in a much smaller circle than one would imagine to be the case. The short outrigeer or bowsprit, is carried to assist the helmsman in his task, as it serves as a pointer

Prediscovery Photographs of Espin's Nova Lacertae

I N the Astronomische Nachrichten Prof. E. E. Barnard publishes a note to the effect that on three of his photo graphs taken with the 6-inch and 10inch lenses of the Bruce photographic doublet on 1807, August 7th, and 1809,

August 22nd and 24th, a fourteenth magnitude star in to be found in the exact position of Empin's Nova Lacerte. The star also shows clearly and strongly on one of this photographs made with a fi-tine Willard lease of the Shetzertory on 1883, October 11th Careful Lick Observatory on 1883, October 11th Careful measurements of the position of this small star on the plate of 1807, August 11th (47 minutes' exposure), with respect to seven small stars whose positions he has determined visually with a 40-inch Yerkes retract, give results which agree with the position of the Nova. It would, therefore, appear that the Nova before this outburst of rat least 17 years caticated in its present state as a fourteenth magnitude star. The magnes on the various plates seem to show that the star was plahaps subject to fluctuations of at least one magnitude.

Prof. Barnard states that in the 60-line isle-scope of Yerkee Observatory the image of the Nova coupled Yerkee Observatory the image of the Nova Central Couples of the Section 1 of the Section

Prof. Barnard adds that he has never seen this peculiarity in other stars and applains it by the great brilliancy of the orimson alpha line of hydrogen in Nova Lacerts, as is shown on spectrograms made at Yerkes Observatory by Prof. Frost and Mr. Parkhurst.

The Expositions at Turin and Rome

Of the two expositions to be held in Italy, the one at Rome commences on March 27th and the second at Turin on April 29th, and both last until

the end of November. It may be a matter of surprise that two expositions are to be held at the same time in the same country, but the fact is they are conjointly organized and do not conflict. The Turin exposition lying in the northern industrial region will represent manufactures and commerce, while the one at Rome will bear upon artistic ethnologic and historic subjects, thus completing the former. Each of these centers thus has an exposition which represents one portion of the progress of the country which properly belongs to it.

Foot Rests and Their Dangers

POOTSTOOLS and other foot rests cause many more or less serious accidents, atminy because the top of the stool almost invariably projects beyond its feet or base. Foot rests are used more extensively take the more not best or namental feetstool (Fig. 1), is a familiar household object, and foot rests of diverse forms, specially constructed or improvised, are employed in many work abops and factories, not only to support the feet while

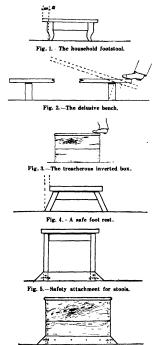


Fig. 6.—Safety attachment for boxes.

FOOT-RESTS GOOD AND BAD

sitting, or one foot while standing, but to stand on while att work. A German engineer, who discusses the subject in Die Umschau, found girts anding on pites of two or three boxes in order to tend tail machines in a certain factory. In another establishment a large bench, constructed as is shown in Fig. 2, was used for piting sheets of paper. The operatives appeared to delight in stepping on this bench whenever it was empty, although numerous falls were caused by the tipping of the bench. Yet nohody took the trouble to secure the bonch against tipping. In such conditions it is not surprising that serious accidents often occur. Even a box or bench of equal dimensions at top and bottom 'Fig. 3), is spit to upset when carelessly stepped upon Mutual bency volent societies have incurred heavy exponse through accidents of the character.

The only safe foot rest is one whose base is considerably larger every way than its top (Fig. 4), and most of the foot rests now in use whether of the stool, bench or box type, can easily be made reasonably safe by securely fastening four beams of triangular section to the feet or base, as shown in Figs. 5 and 6.



[The Editor of the Home Laborations for this department a

Liquefaction of Nitric Oxide

To the Editor of the Home Laboratory:

In the issue of January 21st, there is an article for amateurs on "The Liquefaction of Nitrio Oxide," which should never have appeared in your columns Mr Bowen has very unfortunately selected for his ex-periment a gas which, until the year 1877, had been considered incoercible that is non-liquefiable. He might better have selected the dioxide of sulphur or the dioxide of nitrogen, both of which succumb readily

In the year 1877, Cailletet first liquefied nitric oxide by expanding the gas from a pressure of 104 atmospheres and at a temperature of -11 deg. C. This is pueves and as a temperature of -11 ceg. C. Inits is a similar method to that for the liquefaction of air at the present time. The expansion produces extreme cold. To liquefy nitric oxide a temperature of -93.5 deg. C. must be obtained, this being the critical temperature, a temperature above which a gas cannot be liquefied With this temperature a pressure of 21 iquefied With this temperature a pressure of 71 atmospheres must be produced (Olszewski). This is the critical pressure for the critical temperature of —93.5 deg C. It is because of not having these extreme conditions that the gas was thought to be non-liquefiable. Prof. Dewar has succeeded in both liquefying and solidifying nitric oxide

The experiment cited in your columns is an utter impossibility, for the temperature attained approxi-mates at best -20 deg. C. and the pressure is that of one atmosphere J. H. GRAHAM one atmosphere J. H. Graham Professor of Chemistry, Central High School,

fessor of Chen Philadelphia, Pa.

A Home-made Portrait Attachment for a Camera of Fixed Focus

By Albert S. Getten

THE following describes the manner in which a portrait attachment was made for a pocket camera

A spectacle lens was fastened over the aperture of the camera by rubber bands (shown in photograph) and a piece of ground glass, substituted for the film, was placed in the back of it. The object to be photographed was then moved in front of the lens until a

clear image was formed on the glass

The principle is very simple. The regular lens of the camera is placed so far from the film that the image of an object, removed to a certain distance from which the light rays striking the lens are parallel or which the light rays string the ions are parallel or nearly 20, will be formed sharply and clearly. For an object, however, within a foot or so the image will be formed back of the film and conse-quently a blurred picture will be the re-

The only ways to correct this are to either move the film back to the place where the clear picture is formed or else to shorten the focus of the lens As the first is impossible in a kodak of fixed focus, the last must be resorted to This is accomplished by placing another lens over the first, the focus of this one deter-mining, of course, the range of the

The approximate focil of the spectacl and camera lenses which I used are 9 inches and 4½ inches, respectively. The first was fasiened over the other 1 inch from it, while the object photographed was 9 inches from the camera

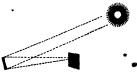
The first portrait attachment which I had I bought for that purpose, but its was so long that an object could be brought no closer than 31/4 feet to be photographed with digtinctness, so I made the attachment above described. This has not only worked with remarkable dis tinciness, but permited me to get a halfsize picture of the object. (The "Billikin" is 5 inches bigh, while his picture is 2½ inches.)

nign, wates his picture as 225 incomes.) In order to get a photograph of the camera with its attachment, it was necessary for it to take it's own picture, nighther camera being available. This was accomplished by placing it 44 inches from a mirror and letting the fifth expose two minutes.

Construction of a Four-and-a-Half-Inch Rede

By Albert R. J. F. Hossard

I N view of the recent revival of interest which has a taken place in estronomical studies and of the fra-quest letters I have received from different quarters of the world, inquiring how the writers might con-struct inexpensively for themselves telescopes, I ven-ture to merchanter of the formula. I this course I take ture to contribute a few sentences to this journal. Like your contributor, Mr. Mellish (Scientific American, October 1st, 1910) I have made several large instru ments, which have given much satisfaction. since very large telescopes are difficult to make, par-ticularly for those who are inexperienced, it is my desire to explain merely how I have made a small 41/4inch reflecting telescope at a very trifling expense. The entire cost has not much exceeded one dollar. Being a lawyer by profession, it has been only during spare



Testing the focus of the reflector.

ments in the evenings or mornings and on holidays that I could give attention to this interesting re-The first telescope I made took me about a year, the last only a few hours.

First, to make a 4/2-inch reflector, it is necessary to procure a piece of plate-glass 41/2 by 9 inches. With a ten-cent glass cutter cut this across in the center, making it into two squares each 4½ inches square With the glass cutter draw a 4½-inch circle on each square, and with a 1ew scorings of the cutter into the glass in various places outside the circles, and also the help of a pair of piters, and the circles left in cut off without much trouble, and the circles left in cut off without much trouble. By running the edges quite a presentable condition. By running the sales on a grindstone, the circumferences of the circles may be made both smooth and fairly true.

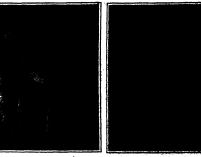
Now cement one circle to a corner of the work bench, and to the other cement a large cotte or similar piece of wood. A piece of a cylindrical curtain pole 1% inches in diameter and 3 inches long The cement used is merely pitch-common black, hard pitch. On the surface of the disk of gl cemented to the work bench lay a haif teaspoonful of sand, emery, or carborundum; if emery or carborunuse grade about 40. Wet it slightly, and rub one glass on the other, by keeping th ways across the lower glass, so that the upper glass crosses the circumference of the lower glass about 3 inches back and forth. Keen moving around the bench. and keep revolving the upper glass by the handle, so that never twice will the two glasses cross one another in the same direction. By this irregularity of move-ment comes the regularity of figure. In a minute or two fresh sand, etc., will be needed; and by one-half

a printed so the li be longer, proceed with the printip further until that distance is accommon finer sand or finer carborandsian or the finer sand or finer carbornadius or samer, said, with it, only use aborter schools. Continua sinks with it, only use aborter schools. Continua sinks and finer and, sto., urtil all the small holes, is since disappear and until the surrow becomes mooth. Then procure about 1 bound of "Sout" in which is like a srayish dust. Four it into any which is like a srayish dust. Four it into any other continuation, and the same state of the same state o pour off all the water, and it will be found to pour or an the water, and it well se require that; early the control or havier emery will be sich. Each at we tiself in a small jar or bottle, and label it "No. I." Then stir up the water which was poured off, for a minute or two, and allow the mixture to stand a Then pour off the liquid quickly and on minute. Then pour off the liquid quickly and carry-fully, and mark the enery left in the botkens "Not A" Continue thus, only allow the liquid to rest after the second time as follows: Three minutes, 7 minutes, 80 minutes, and 1 hour. In this way the last enery will be of the finest possible character, and the liquid will be of a ruddy color. The last enery will be "No. 4." Grind about 10 minutes with each grade, beginning Grind about 10 minutes with sear grade, reginning with No. 1, and by the time No. 6 has been used, the surface of the gless should be exquisitely fine, and without either hole or scratch. Should such not be the case, seturn to a coarser grade of emery, and use it until the holes made by the prior grade are removed. When No. 6 is finished, the glass should be almost

Now on top of the glass comented to the bench, pour some meted black pitch; wet the upper glass and press it on the pitch, so that the surface of the pitch may take an impression of the face of the upper glass. Then procure 1 ounce of jeweler's rouge (if sknown as the red oxide of tron), hay a small quality of it on the pitch, wet if, and revolve the upper glass, out tilligenth. An hour of sky, will share the content of the upper glass, to get the upper glass to get the upper glass, to get the upper glass to Now on top of the glass ceme of the upper giasa to a period confurther treatment of the special to the second of the treatment of the special that an all on the sai flustrated, and the image the sun will be quite distinctly. It will not sun will be se rement be reached exactly 3-foot focus, and in anoth surface of the glass must inch, and this wan be to as the Foucault test, while to explain here. The glas es not permit washed in a bath smically clean, to explain here. The gra-of anything and anything generally.

water, 5 minhuri strengthener if require. potasli, 2 od liver the glass thus strengthener requires. Trenty for the mass that of success the contract of the chemically pure caustic potash (in stick form) in 2 ounces of water. Mix & with the nitrate of silver, water, and ammonia. All will turn black. Then and slowly rop by drop ammonia again, and it will begin to clea All the while stir it with a piece of wood or giasa rod. Then add a small solution of alreate of silver and water (10 grains nitrate and Tablespoonful of

water (to praise intrace and I ambrepoortie to water) until the liquid which was nearly clear begins to get a little darker or ruddy. Lay aside. Call this solution A. Make solu-tion B thus: Six ounces pure water (boiled), 1 tempoonful of white sugar, I teaspoonful of pure alcohol, 3 or 4 drops of nitric acid. This grows better as its grows old. To solution A add .. tea re grows old. To solution A and I to spoonfuls of solution B, and put it into saucer, Stir rapidly for one-half manners the glass, contains the class, of the court of the class of the court of the cou fully immersed in the liquid. In a few minutes the silver will be seen rising mic adhering to the glass. In about 10 is utes the glass will be fully covered, w it may be withdrawn. Let sor ter run on the for a few minutes, and see small place of flat p



Portrait taken with a pocket camera.

The-comers taking its own picture.

hoar it will be found that the upper game in occurwhite the lower one has become convex.

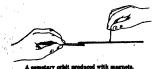
Now wet the surface of the upper gams and hold
quickly the wet face to the sur; watch where; the one
makes the best and similar times on a crimin, is if
the accompanying drawling. If the best store, if yet
from the microv's author, it is time to done the occu-

they at explore must be placed. At that point, their use freign through the graphon, there will appear, houry threst salarged, the object at which the along its directed. squart he placed. At that point,

Gaughie Demonstration of Cometary Orbits By B. C. Batcheller

Except for these samilies with higher mathematics and physics, it is difficult to understand how a comet, can approach the sun with an ever-increasing speed, swap around so close to it, and then more away without being drawn into it by the tremendous contractions. tores of gravitation.

The B tion of the comet relative to the sun can be fliestrated in a simple manner with two perm ment marnets. One magnet may be made of a straight nent magnets. One magnets may be made or a straight spee of stead wire 8 inches long and ¼ of an Inch dismoter, the other of a straight steel rod 6 inches long and ¾ of an inch diameter—the exact size is not important. Both must be hardened and magnetized as strong as possible. Suspend the longer magnet like a compass needle, by a fine thread tied to the middle, ting through a wide angle santal plane by means of the other masnet held in the hand. As the north pole of the suspended magnet swings, say, from left to right, bring the south pole met, held horisontally in the h to a position just beneath the plane in which the suspended magnet is swinging, so that if it continued to swing in that plane, its north pole would pass over the south pole of the magnet held in the hand. If the south pole of the magnet held in the hand is brought too near to the plane of the swinging magnet, then the two poles will be drawn together. On the other if the south pole of the magnet held in the hand is not brought near enough to the plane of the name is not covering to her could be swinging magnet, then the north pole of the swinging magnet will pass the stationary south pole with only a slight defection. If the south pole of the magnet held in the kand is brought to just the right distance



from the plane of the swinging magnet, then the north sole of the swinging magnet will describe an approxi-mate arc of an ellipse around the south pole of the et held in the hand, passing quite close to it, but not touching it, as the comet passes around the sun. The pole of the swinging magnet moves with an accelerated speed as it approaches the pole of the stationary magnet, and with a retarded speed as it recodes from it, in accordance with a similar law to that which accelerates and retards the comet in its path around the sun.

The first few attempts to perform this experiment will probably result in failures, but a little patience is sure to be rewarded with success. I did it the first time by accident, but since then have repeated the experiment many times.

A Medified Form of the Opeidoscope By C. S. Bourne

N studying the vibrations of forks or of membranes, it is of great interest to the experimenter to make

At is sef great indress to the experimenter to make those without soptically apparent.
The opsidoscope—as called by Prof. A. E. Dolbear, who devised the little apparatus some years ago—pro-vides a simple device for producing that effect. It reducings of a Bube of in or paper several inches long, with a membrane of very thin rubbar tied over one soft, to the centur of which is gived a small bit of inchinageine about, oncedight of an inch in diameter. looking-giase about one-sighth of an tach in diameter. By leoting it hear the window in such a way as to reduct a small sunbears to the white wall of the region and then singing different notes into the open said, the sun spot changes and describes harmonic convex in response to the pitch of the voice and the possible with the possible displacines of the membrane. At one pitch the will, assume a structure like, again a well-defined the contraction of the pitch of the p then an ellipse, and perhaps a figure 8, varying

a separatementing with this sample device, the feet has empericaned the adem attenuity as others are in being obliged to empericane an owner ward and shad instance in order to restor this embount to have good walls on same time bodding the same at the bodding another than the same at the beingth devertable showers.

to any angle desired. With this arrangement one may direct the sunboam with far greater case than with the single straight tube.

Anyone may make this device with common paper mailing tubes, the parts to form the elbows being glued at the edges. The instrument is well worth the time spent in making it; and with the window shades drawn to darken the room as much as possi-



Improved opeidoscope

ble, it will be found an interesting source of

In a school room provided with a heliostat, the

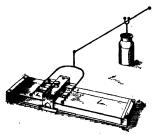
An Easily Made Leyden Jar Charger By H. B. Dailey

ONG before he has acquired the a Liskill to warrant an attempt to build for himself the somewhat difficult influence machine, many a youthful electrical enthusiast has at some time or another felt the longing to reproduce for his own benefit at home ne of the fascinating experiments he has seen exhibited in electrostatic physics.

To such it should be interesting to realize that many of the most beautiful and instructive of elemen tary demonstrations of static electrical phenomena are among those that require only the single charge of a small Leyden jar for their presentation. Physiological effects; the puncturing of refractory materials, and other disruptive manifestations, such as the breaking of tightly corked glass tubes filled with water through which the discharge is passed; ignition of gunpowder and volatile fluids; momentary filumination of inter-rupted conductors; chemical union of oxygen and hydrogen in the gas pistol; the ringing of static electric chimes and various other interesting illustrations of electrical attraction and repulsion; simple experiments in Hert.ian waves; these are but a few of the pleas-ing experimental possibilities of the Leyden jar and single charge.

The simple arrangement here illustrated will charge a pint size Leyden jar to a high potential in a few moments. The apparatus requires no machine work in its construction and can be built in a few hours with common tools

A strip of plate glass 8 x 33 inches, with parallel edges is supported at its ends upon shouldered cleats attached to a suitable baseboard, the glass being elevated about 2½ inches above the board. An amaigamcoated, chamois-skin-covered, rubber block adapted to be moved back and forth by hand along the glass, car-ries a pair of insulated collecting combs which gather



Device for charging Leyden jars.

nal electricity from the glass, transmitting it through an oscillating rod to a Leyden jar standing a short distance to one side of the charger. The body of the rubber block is formed of two superposed pieces of nort wood, each % inches thick and 4 inches wide, having a length slightly greater than the width of the glass plats. Thin hardwood guide pieces-shaped as in the illustration, attached to the ends of the rubber block, guide the movement of the latter by engaging the edges of the baseboard.

The collecting combs are carried by a rectangular insulating strip of plate glass measuring 6 x 10 inches which is clamped at its middle across its narrower dimension between the two haives of the rubber block, the upper half of which is channeled transversely to receive the sizes. The collector combs consist of two

rows of downwardly directed metallic points reaching nearly to the glass, attached to the under sides of the parallel limbs of a U-shaped loop of stout brass or copper wire, which is bound to the ends of the ating plate with two or three tightly drawn bands of half-inch silk ribbon

The points, which are placed about half an inch apart, are made by soldering short common pins by their heads to the collector rods, the rows of points being slightly shorter than the width of the friction glass on which the rubber glides To keep the comb-loop from slipping off the ends of the insulating plate small holding clips made from rectangular strips of thin sheet brass, bent into U form, and measuring before bending % × % inch, are soldered round the body of the comb-loop at the point where the binding on is to be applied, the ends of the clips extending a very short distance upon the surface of the insulating Thick shellac varnish is applied to the inner surfaces of the holding clips and the binding ribbon applied over them, after which the insulating plate including the ribbon is well coated with shellar which renders the attachment permanently firm.

In making the friction pad, two thicknesses of chamois skin exactly the size of the rubber block are laid upon the block's under surface, a piece of tinfoil, of the same size is placed upon these, and a wider piece of chamois skin is drawn tightly over the whole, brought round the edges of the block and fastened with small tacks. The tinfoil within the pad is elec-trically connected with the hand-knob on the top of the rubber block through a narrow strip of tinfoil shellacked round the end of the block and along its top surface before the guide-pieces are put on. The pad is now charged with a thin coating of friction machine amalgam made adherent to the chamois skin by means of a very small quantity of lard applied to the rub ber Amalgam from the back of an old mirror answers fairly, but it is much better to buy a small quantity of the regular kind from makers of laboratory supplies

4-inch piece of ¼ inch brass tubing soldered vertically on the bend of the comb-loop carries a siender os-cillating rod which extends out horizontally between the ball-tipped prongs of the forked stem of the Leyden jar The nearer end of the rod terminates in a %-inch metal ball provided with a vertical stem which turns freely in the tubular socket. the escape of electricity into the air the terminals of the comb-loop, oscillating rod, and jar fork are protected with smooth brass or leaden balls, and projecting angles, and sharp corners are carefully avoided.

A few movements of the rubber along the glass charges the jar which may then be detached from the apparatus and its charge used in any desired

Au excellent Leyden jar for this arrangement can be made as follows. Secure a tall tumbler of thin blown glass and coat it within and without with tinfoil to about half its height, attaching the foil with shellac varnish nearly dried Put several ounces of fine shot into the tumbler to give it stability.

Stand the forked stem vertically in the shot and pour melted paraffine into the tumbler to within 1/4

inch of the top of the tinfoli coating.

If plate glass is not available for the agracultus double strength window glass is equally effective electrically, but should this be used the friction plate should be supported in several places with vertical pieces of glass tubing let into holes in the baseboard

Like all machines of the frictional type the pres apparatus requires the dry cold weather of winter for its most successful operation. Warming the friction plate and occasionally stirring up the amaigans on the rubber add considerably to the machine's ef-

How Clouds Get Their Fringes

YNDALL used to explain to popular audiences, with the aid of a brilliant experiment, that the blue color of the sky is owing to floating particles of invisible dust that break up and scatter the short waves, which are the blue waves, of light This, as has re cently been pointed out, occurs principally at a great elevation, where the atmospheric dust is extremely fine, while in the lower regions of the air, where the dust is coarser, the scattering affects all the rays, or colors, alike The brilliant fringes of clouds seen nearly in the direction of the sun, are largely due to dust, which especially accumulates in the neighborhood of clouds, and refracts the sunlight around their

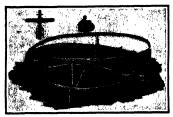
A Correction

THE article on the Unique Wind Vane and Elec-tric Indicator, appearing in our issue of January 2jst, 1911, was prepared by Mr. James L Blackmer, the constructor of the instrument, and not by Mr. Frank C,

Curiosities of Science and Invention

A Toy Gyroscopic Monorail

THE mystery of the top, which has in recent years been taken up by the practical technical man, and put to various uses, such as the guiding of torpedoes, the balancing of a car on a monorall, the prevention of the rocking of a vessel in a seaway, etc., is attractive to the small boy However, should he have tired of the common form of scientific top, his inter-



Gyroscopic gymnast on a spiral monorail.

est will no doubt be revived by a recent innovation. hailing from England, which is pictured herewith. This consists of a sort of monorail car of very simple construction, which will travel around a spiral track, or any other form of track provided for it. The familiar gyroscope wheel is mounted in a frame, upon which is the figure of a gymnast. At the bottom of the frame is a roller grouved to fit the spiral track. One flange of the roller, however, is of slightly larger diameter than the other, as shown in the detail view, and on this projecting flange the shaft of the gyro scope wheel bears Owing to the eccentricity of this tact, the shaft as it rotates serves to drive the Thus a step down friction gear, in which the roller. Thus a step down friction gear, in which the reduction of speed is very great, is produced in an exceedingly simple manner. The wheel is revolved at high speed by the usual method of wrapping a string around the shaft and whipping it off quickly. When the roller is placed carefully on the track, the shaft of the gyroscope wheel resting on the larger flange of the roller causes the device to propal itself along the track The manner in which the figure takes curves and traveis steadily uphill or downhill without upsetting is very puzzling and interesting, and makes a very simple demonstration of the principles upon which mono-railroads operate

Mission Style Observation Car

THE latest departure from old-fashioned ideas in the construction and decoration of railroad cars is shown in the accompanying photograph of a car built in the Mission Style. This is an observation coach which recently made its inaugural run over the "kiteshaped track" of the Santa Fé system in Southern

As this country was the scene of the labors of the



A mission style observation car.

Franciscan Fathers, it is quite fitting that travelers should be reminded of these early colonists, not only in the architecture of the homes and public buildings of Southern California, but even in the design of this luxurious. Description car. True to the spirit of mission architecture, there is a certain artistic simplification the fittings of this coach, which is paneled in

pearl gray leather and weathered cak. The revolving pear; gray leading and weathered and the lamp brackets and the chandellers, designed after a mission bell, remind one constantly of the Padrés and thair work.

The details of construction do not differ widely from other modern cars except that this one is larger and more costly than the average. It has a length of

76 feet, and weighs 133,000 pounds. constructed on a solid steel frame with a center beam of steel running the length of the car underneath, as a reinforcement to prevent telescoping.

Curious Geyser in Florida

A BOUT four or five years ago, in the vicinity of Orlando, Florida, a natural sink, which is some one hundred feet deep and forms a small lake about two hundred yards across, became obstructed, thereby causing about one thousand acres to be

The numerous lakes which shound in the vicinity of Orlando overflowed into it. Many ways were tried to remove the cause of the obstruction. A diver with dynamite was sent down, and several charges were exploded, but proved of no avail.

gested that pipes be driven several hundred feet, to try for an underground passage. This was done, and proved a success



A curious geyser in Florida

So the lakes, which number thirteen within the corporation limits of Orlando, are brought to their normal water line It was soon discovered that for several

miles around Orlando these pass existed some four hundred and fifty to five hundred feet below the surface of the ground. The water level at Lake Fairview, some three miles out, became too high for the truck gardens, so a ten-inch pipe was driven about four hundred feet deep. The water in the lake at the present time is about five inches above the pipe, which is driven in the border of which is driven in the border of the lake. Every six minutes a thirty-five foot gusher is formed-and delivered. It is probably caused by air rushing down the pipe with the water and collecting in a natural chamber to a greater pressure than would be produced by the head of water because of the When the pressure reaches a critical point it stops the flow of water reverses it, and rushes out with it

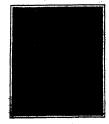
A Miniature Electric Motor

O NE of the tinest electric motors O NE of the timest electric motors ever holist was recently constructed by M. G. Trevet at Believus, França. It works most satisfactorily in apite of its marredously small simulations, and has been prescuted by Carpoline to the Franch Academy of Sciences.

This motor is a shunt-wound machine with Gramme ring, the dimensions of the inductor being as follows:

Height, 0.57 inch; width of base, 0.55 tuen; tength of shaft, 0.59 izoh.

shaft, 0.85 inch.
The exciter coil comprises 600 turns of a wire,
two ten-thousandths of an inch in thickness. The inductor iron is 0.025 square inch in cross section, and
1.25 inches in average length. The architect, which
is 0.34 inch in diameter, comprises tradys death. Its
windings are subdivided into six sections, and with



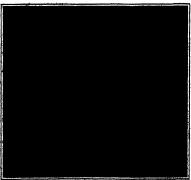
Complete electric motor only half an inch high.

288 turns, and yield a useful length of 51/4 feet. The commutator comprises six plates kept together by two ivory cones and insulated by six ebonite plates, the whole being secured with an hexagonal nut on a brass tube forced upon the shaft. The leads are connected to minute terminals, the commutator diameter being only 0.1 inch. Each of the brushes consists of two plates kept together by three riveted cross-stays and pressed permanently against the commutator by a ring, screw and spring A piece of silver-in the place the contact. The dimensions of the brushes are as fol-Length, 0.12 inch; width, 0.04 inch; height,

The brush-holders are adjustable, connection with them being made by perforated acrews. The steel shaft is 0.03 inch, and the bearings only 0.016 inch in diameter. The motor in full operation uses up 0.3 ampere with a tension of 3.5 volts, viz., an energy of 0.7 watt. Its total weight is but 0.24 ounce avoirdu-

A Sun Bath in the Snow

WE have frequently heard of Eskimos who have enjoyed diverting themselves of all clothing and taking a sun bath in the snow. Occasionally we hear of white men who claim to enjoy such a bath.
Whatever doubts we may have had heretofore have been dispelled by the accompanying photograph, which shows the mountain climber, Paul Reinwald,



g off after a strongous alimb.

scoling off atter a stremous climb up "Old Baldy" is possiblem California. The photograph was taken by the climber bisself on Chebranes day in 1889, tellug an signistic circuit; and a mignatic resispe do sprice; the shifter. The wire may be broadly saisly dis-sory in the fashground.



The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting



as Slitting and ng Machine

By The mas D. Gannaway FeW people realize the magnitude of the Government's postage stamp indus-

try. It has grown to proportions which the mind finds it difficult to greep. So at is the demand for postage stamps that a ferce of several hundred men and en is kept working all the time to make and issue that seemingly insigni-cant article of public consumption. If you will consider that a sheet of 100 stamps only weighs about as much as two blank sheets of ordinary paper of the same size, and that it takes about 550 tons of paper, about 225 tons of ink, and about tone of sum to make the supply of stames for one year, you may begin to realise the vastness of the stamp business; and it is constantly growing. The pos stamps were, at one time, all sent from the Bureau of Engraving and Printingwhere they are made—to the Post Office Department, and then issued to the various postmasters all over the United States, as ordered by them. As the is-sues grew rapidly, the task became so great that the officials decided to avoid the unnecessary handling involved in sending the output to the Post Office De-So it was arranged that the Bureau of Engraving and Printing should issue the stamps directly to the postmas-ters, and they are now being sent out at e astonishing rate of about eleven billions (all denominations) a year. This is equal to about thirty-one millions a day, which is equivalent to twenty-one sand a minute, or about three hundred and fifty per second for every second in the year. In this era of progressiveness, when the inventive mind is on the alert in every branch of business, there have been invented a number of machines for affixing postage stamps to let ters, so as to save the time and trouble of tearing off, licking, and pasting the stamp of the letter. These machines are very small, measuring only a few inches each way. They cut the stamp loose from the coil, moisten the gummed surface, paste it onto the envelope, and at the same time count the number of stamps used All the operator has to do is to place the envelope in the machine and then strike the latter with one hand, the machine does the rest. When he has finished stamping letters, he looks at the indicate (or register) to ascertain how many stamps have been spent. For use with this machine (which is of great convenience to private concerns) the stamp stamp wide and rolled up in a coil. The desire to use these machines created a d upon the Government to prepare and issue stamps in coils. Mr. J. E. Ralph, Director of the Bureau of Engraving and Printing, wishing to accomble, undertook to prepare stamps to machines, sufficient to meet the ind. At first it was not a very diffsit. The stamps are printed in America, stamps square. Those were performed lengthwise and nd running drosswise of the per-al A small blank margin is left and of the wirips and a number e are then testened bland, Then a se

tached to an ordinary office table. An-jeharge of this division, tells me it has in-jehines, invented by Mr Benjamin Stickother operator takes the long tape of creased about two hundred per cent in stamps which is being made by pasting the last year. The increased demand for the strips together, and winds them on colled stamps is the result of the introduc But the demand for stamps put up in this form is growing at a remark- work alone

this reel, until she has five hundred or a tion of improved methods for applying thousand stamps, as desired. Until very stamps, and it is the judgment of Mr recently this was the only method known Ralph, the Director, that within a year

for colling postage stamps, and, at first, or two colled stamps will be universally was quite adequate to meet the require-

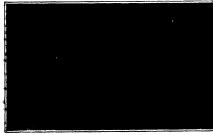
Thirty operators are employed on this work alone But with the advent of some able rate. Mr. F. Campbell, who is in new automatic separating and coiling ma-

ney of the Bureau, it is expected that it will soon be possible to fill all orders promptly

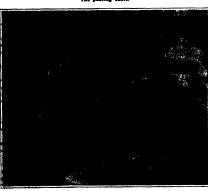
For these machines, the original sheet of two hundred stamps is perforated as before, but instead of being out into strips, it is cut only once, crosswise of the perforations. This leaves the half sheets ten stamps wide and twenty stamps long. These half sheets must be pasted together endwise before they are fed to the machine. This is done on the long tables shown in our first illustration. sets of manila paper of the same width and not quite as long as the half sheets of stamps have ten labels printed on them so as to correspond with the ten rows of stamps, and on the opposite side is a strip of gum running crosswise of the These sheets are used to make the core on which the stamps are wound and so for wrappers for the individual coils Before the sheets of stamps are carried to the pasting tables they are arranged ccording to the size of coils to be made. If coils of five hundred stamps are to be made, a sheet of the manila paper labeled as five hundred is put down as a starting se, then twenty-five sheets of stamps, another sheet of manila paper, then another twenty-five sheets of stamps, and so on, until enough are piled up to fill one of the large spools for the machine If coils of one thousand stamps each are to be wound, sheets of manila paper labeled as one thousand are used and then fifty sheets of stamps are placed between them

The operator at the pasting table takes the sheet of manila paper off of the top of the stack of stamps and places it to her left, i e, between the spool and the aluminium bar which extends across the renter of her table. She then takes the first sheet of stamps with her right hand and slips it under this aluminium bar so that the end of the sheet is even with the opposite edge of the bar The next step is to attach the sheet of stamps to the manila paper In a slot under the aluminium har is a small cylindrical tank shout two inches in diameter and five inches long. This is fitted with a small sponge like flat wick one-fourth of an inch thick and one inch wide. The tank is filled with water and then closed, and the wick, which is fitted in it like an ordinary lamp wick, extends up far enough to touch the bottom of the aluminium bar. The operator then-while holding the stamps in place with her right hand-takes hold of this tank with her left and pulls it across the table toward her and then pushes it back. The wick thus moistens a strip of the gum all the way acros the end of the sheet This is then slipped through and pasted onto the sheet of manila paper The next sheet of stamps is taken and treated the same way and then nasted onto the one which has but passed through. As this is done they are wound on the large spool at the end of the table. Vhen this spool is filled it is ready for the automatic coller

As will be seen by the accompanying cuts, this machine is very compact, but it is capable of doing a large amount of work. One of the large speeds from the pasting tables is put into the machine, as shown in our illustrations The last sheet put on the spool is manila paper and this is started through the machine which is equipped with nine rotary knives and is cut into strips of the same width as the strip of stamps. The machine has ten spindles, each carrying a



The pasting table.



Rear view of the stamp coiling machine.



Front view of stamp coiling machine

AUTOMATIC STAMP SLITTING AND COILING MACHINE

small reel flanged on one side (see our second illustration). On these reels the stamps are wound. The end of the reels are split, and each is fitted with a ratchet so that anyone of them can be turned by hand without moving the spindle machine is threaded, as it were, by taking the ends of the manila paper which has been started through, and putting one of in the split end of each reel and turning it until the strip of paper is straight. This makes the cores for the first coils of stamps. The machine is then started (the motive power being electri city) and almost before you have had time to realize what is happening, the second sheet of manila paper is seen passhave been completed. The machine is then stopped and with a pair of scissor the strips of paper are severed, leaving a certain length of gummed strip extend This is wound up by ing from each coil hand and pasted down, thus making a wrapper for the coil After the coils have all been removed from the machine, the ends of paper left in it are threaded up as before, thus making the cores for the next ten colls.

At present the Government has only one of these machines and three pasting tables, but more are being built. The four operators which it takes to handle are coiling as many stamps as twenty-two workers could make by hand. thus saving \$12,000 to \$15,000 per year to the Government.

The machine has a capacity of twelv hundred colls of five hundred stamps each in seven hours. The cost of installation including the three pasting tables is les than \$1,000; therefore it will save sev eral times its cost in one year.

The New Trade-Mark and Patent Treaties

THE United States Senate on February 8th, 1911, approved the conventions by the Fourth International Congress of American States at Buenos Aires and signed August 20th, 1910, relating to the protection of trade-marks and pat These conventions which were prepared by the United States delegation, for which the Commissioner of Patents, Mr. Edward B. Moore, was the expert attaché, were adopted, after a most thorough and exhaustive consideration, dur ing the closing session of the Congress Their adoption was of course subject to ratification by the various governments and the United States Senate Committee on Foreign Relations has had them under consideration for several months, but the treaties were not made public until the

The following are the more important articles on trade-marks

Article II -Any mark duly registered in one of the signatory States shall be considered as registered also in the other States of the Union, without prejudice to the rights of third persons and to the provisions of the laws of each State govern-

ing the same

Article III -The deposit of a trademark in one of the signatory States produces in favor of the depositor a right of priority for the period of six months. so as to enable the depositor to make the deposit in the other States.

Article Vi -- All questions which may arise regarding the priority of the de-posit or the adoption of a trade-mark shall be decided with due regard to the date of the deposit in the State in which the first application was made therefor. Article VII -The ownership of a trade

mark includes the right to enjoy the beneffit thereof and the right of assignment to protect industrial property. In case or transfer in whole or in part of its such conferences take place, the director

by the interested party in accordance with the laws of the State wherein the

Article IX.-Any person in any of the signatory States shall have the right to netition and obtain in any of the States. through its competent judicial authority the annulment of the registration of a trade-mark, when he shall have made application for the registration of that mark, or of any other mark, calculated to be confused, in such State, with the mark in whose annulment he is interested, upon proving:

(a) That the mark the registration whereof he solicits has been employed or used within the country prior to the em ployment or use of the mark registere by the person registering it or by th

persons from whom he has derived title; (b) That the registrant had knowledge of the ownership, employment, or use in any of the signatory States of the mark of the applicant, the annulment whereo is sought, prior to the use of the regie ered mark by the registrant or by those from whom he has derived title;

(c) That the registrant had no right to the ownership, employment, or the registered mark on the date of its de-

(d) That the registered mark had not en used or employed by the registrant or by his assigns within the term fixed by the laws of the State in which the registration shall have been made.

Article X.—Commercial nam protected in all the States of the Union vithout deposit or registration, whether the same form part of a trade-mark of

Article XI.-For the purposes indicated in the present convention a Union of American Nations is hereby constitut which shall act through two international bureaus established one in the city of Havana, Cuba, and the other in the city of Rio de Janeiro, Brazil, acting in com plete accord with each other.

Article XII.-The international bureaus hall have the following duties:

1. To keep a register of the certification of ownership of trade-marks issued by

any of the signatory States. 2. To collect such reports and data as to the protection of intellectual and industrial property and to publish and circulate them among the nations of the Union, as well as to furnish them whatever special information they may need upon this subject

To encourage the study and publicity of the questions relating to the protecerty; to publish for this purpose one or more official reviews, containing the full texts or digest of all documents forwarded to the bureaus by the authorities of the signatory States.

The governments of said States shall end to the International American Bu reaus their official publications which ontain the announcements of the regis trations of trade-marks, and commercial names, and the grants of patents and privileges as well as the judgments ren dered by the respective courts concerning the invalidity of trade-marks and pat

To communicate to the gove of the Union any difficulties or obstacles that may oppose or delay the effective ap-plication of this convention.

5 To aid the governments of the signatory States in the preparations of in ternational conferences for the study of legislation concerning industrial prop erty, and to secure such alterations as is may be proper to propose in the regula tions of the Union, or in treaties in force

same time to all the government other States of the United, 7. To initiate and establish

with similar bureaus and with the neter tific and industrial associations and in stitutions for the archange of publics tions, information, and data con the progress of the protection of industrial property.

8. To investigate cases where trade marks, designs, and industrial models have failed to obtain the recognition of registration provided for by this conven tion, on the part of the authorities of any one of the States forming the union, and to communicate the facts and reasons to the government of the country of origin and to interested parties.

9. To co-operate as agents for each on the governments of the signatory States before the respective authorities for the better performance of any actending to promote or accomplish the ends of this convention.

Article XIII .-- The bureau established in the city of Havana, Cuba, shall have charge of the registration of trade-mark coming from the United States of Amer ca, Mexico, Cuba, Haiti, the Dominican Republic, El Salvador, Honduras, Nicara

gua, Costa Rica, Guatemala, and Ranam The bureau established in the city of Rio de Janeiro shall have charge of the registration of trade-marks coming from Brazil, Uruguay, the Argentine Republic Paraguay, Bolivia, Chili, Peru, Ecuader

Article XIV-The two internations bureaus shall be considered as one, and for the purpose of the unification of the registrations it is provided:

(a) Both shall have the same books nd the same accounts kept under an identical system

(b) Copies shall be reciprocally trans mitted weekly from one to the other of all applications, registrations, communicaand other documents affecting the recognition of the rights of owners of trade-marks

Article XVI.-The governments of the Republic of Cuba and of the United States of Brazil shall proceed with the organiza tion of the Bureaus of the Internations Union as herein provided, upon the rati-fication of this convention by at least two-thirds of the nations belonging t each group.

each group.

The simultaneous establishment of both bureaus shall not be necessary; one only may be established if there be the er of adherent governments pro vided for above.

Article XVII.—The treaties on trade

marks previously concluded by and be tween the signatory States, shall be substituted by the present convention from the date of its ratification, as far as the relations between the signatory States are concerned.

Article XVIII.-The ratification or adhesion of the American States to the present convention shall be communicated to the Government of the Argentine Repub lic, which shall lay them before the other States of the Union. These communics. tions shall take the place of an exchange

The following are the more important

rticles on patents: Article II .- Any parsens who shall ob ain a patent of invention in any of the signatory States shall enjoy in each of the other States all the advantages which the laws relative to patents of inves designs, and industrial medels concede. Consequently, they shall have the right to the same protection and identical legal remedies against any attack upon their rights, provided they comply with the laws of each State.

effit thereof and the right of assignment to protect industrial property. In case for each State, we can state, one of transfer in whole or in part of its successful part of the provisions of the laws of the results and there to express the provisions of the laws of the results and there to express the provision of the laws of the results and there to express the provision of the laws of the results and there to express the provision of the laws of the provision, into the order of the provision of the laws of the provision into the provision of the laws of the provision into the provision of the laws of the provision into the provision of the laws of the provision into the provision of the laws of the provision into the provision of the provision into the provision of the provision of the provision into the provision of the provision into the provision of the p

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ly made in ser periods can not acts performed in the inter-by other deposits, by the s the invention or its working, sale of copies of the design as

Article IV .-- Whe fixed, a person shall have filed ap tions in several States for the pate the same invention, the rights result from patents thus applied for shall be

They shall also be independent of the rights arising under patents obtained for the same invention in countries not par-ties to this convention.

Article V.-Questions which may a regarding the priority of patents of inntion shall be decided with res the date of the application for the respective patents in the countries in they are granted.

Article VI.—The following shall be considered as inventions: A new man of manufacturing industrial produ new machine or machanical or manual apparatus which serves for the manufacture of said products, the discovery of a new industrial product, the application of on of known methods for the purpose of securing better results, and every new. original, and ornamental design or model for an article of manufacture.

The foregoing shall be understood without prejudice to the laws of each State

Article VII.—Any of the signatory States may refuse to recognize pate for any of the following causes:

(a) Because the inventions or discoveries may have been published in any country prior to the date of the invention by the applicant

(b) Because the inventions have been registered, published, or described in any country more than one year prior to the date of the application in the country in which the patent is sought.

(c) Because the inventions have be in public use, or have been on sale in the country in which the patent has been applied for, one year prior to the date of

(d) Because the inventions or disc eries are in some manner contrary to morals or laws.

Article VIII.—The ownership of a pat-

ent of invention comprises the right to enjoy the benefits thereof, and the right to assign or transfer it in accord with the laws of the country.

Article IX.-Persons who incur civil or criminal liabilities, because of intrales or damage to the rights of inventors. shall be prosecuted and punished in ac cordance with the laws of the countries wherein the offense has been committed or the damage occasion

Article X.—Copies of patents certific in the country of origin, according to the national law thereof, shall be a full faith and credit as evidence of the right of priority, except as stated in Ar

Article XI .- The tranties relating to patents of invention, designs, or industrial models, previously entered into be tween the countries subscribing to the present convention, shall be supers by the name from the time of the ratifica. tion in so far as the relations b the signatory States are com-

Validity of Recent Patents, Out-eight adjudicated patents, one of with was a release, reported in the Patents, See Official Gaussias of January 21st, 16 the original point, the or

Logal Notes
Patent Appeals A novel
d in Avery against Ocea, 174
gener, 142 One Holselew, an paints, indicator, 141. One Holocium, an inventor, of his linguoyament, had made application; by the Patent Office for a patent. Suffers his patent issued mother inventor, before interested, by applying for a spitart on a like subject-curtor. The Museumber of Interferences determined in Ever of Holocium, upon the disclosure in the Sobey application that the investion and not been concerved by him until after the filing of the Hols-cias application. Thereupon Sobey, to de-lay a final issuance of the Holsciaw patent, lay a mast mename or the Homolaw patent, moved for a vacation of the Examiner's judgment; which being denied, he ap-pealed to the Examiner in Chief; which being denied, he appealed to the Com-missioner of Patents; which being denied, he moved for a rehearing before the Commissioner; which being denied, he appealed to the District Court of the District of Columbia; which being denied, he petitioned for a rehearing in the Court of Appeals of the District of Columbia; which being denied, he presented a petition to the Supreme Court
of the United States for a writ of certicrari; which being denied, further dilatory steps were taken in the Court of eals and before the Commissioner of Patents. This case is brought for damages in delaying the issuance of the Hoiselaw patent. The court held that the complaint did not state a cause of action for the recovery of damages, be-cause specific damages were not alleged, and the case, if maintainable at all, was one in the nature of trespass on the case for injury and damage to plaintiff, and the mere postponement of the term of its monopoly was not necessarily to

Brief Notes Concerning Inventions

A Remerkable Coincidence.—A patent ttorney whose firm has Washington offices, vouches for the absolute truth of the following story of a remarkable series of coincidences in connection with two cations for patent. The attorney had two clients of the same name. For the sake of the story, we will assume that the name was Linwood. One Linwood lived in Washington and the other in Chicago, and both were personally known to the attorney. The two Linwoods, alto the attorney. The two Linwoods, although not related, resemble such other
personally, both physically and temperpersonally, both physically and temperpatent pending at the same time for pitch
ferent inventions and both the applications were placed in interference, the
party interfering with the Washington
Linwood living in Otherace, and the party
living in New York. In meltine interference
the desired where it is not of the proper of the property terferences the cases were settled by the agreement of the parties, the agreement in Rardware and Teols.

Rardware and Teols.

PILB HANDLE—William B. Warren, 507 should take the right to use the invention for a restricted purpose and the party taking the right for the restricted, in, in which one part is movable relatively purpose in each case was Linwood.

New Flour Milling Patents.—Two United States patents were issued Febru ary 7th, 1997, to a resident of Weybridge England, for processes of milling flour within any thought by some to be of much which any thought by some to be of much the provided of the p tend, for processes of militing flour

RECENTLY PATRICTED INVENTIONS.

These columns are open to all patenties. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Beyartment of the SCHRETIFIC AMERICAN

The weekly Index of Patents issued by the Units States Patent Office will be found in the Scientii American Supplement.

Pertaining to Apparel.

Pertaining to Apparel.

WAIL RACK-M. Lowestry, Midden,
Mass This invention provides a rack for
handing coats, having combined therewith a
box receptacle for a hat, and hanging devices
for romes and unbrellas, and brankes for use
for both rout and hat; provides a hat receptacle to be used in an elevated position; and
provides means for opening and closing the lid
of the lat receptacle.

Of General Interest.

DENTAL MATRIX CLIP.—O. H. BRANON.
Cambridge, N. Y. The improvement provides
to complete the control of t

2 FILE HANDLE

having at its outer terminal a device for kep-letion. The rain, while permitting a free circu-lation in the rain, while permitting a free circu-lation in the rain of the circumstance of the vise being so constructed that it may be placed in the wall of a building with either of its closed longitudinal faces upperment with equally nod results, so that the mechanic in particular to the control of the control of the bow, will be certain to make a proper consec-tion between openings of the recepture on and the atmosphere beyond the conduit. CONVENTIBLE CHARK—A RESMAN, New York CONVENTIBLE CHARK—A RESMAN NEW White CONVENTIBLE CHARK TO A RESMAN which is the control of the control of the control to the control of the control of the control of the west morable into citter of two normal posi-tions according to the form assumed by the chair.

Machines and Mechanical Devices.

Machines and Machanical Devices.
DEEDIGR —W. T RAIN, Seattle, Wash. Mr.
Rainse improvement pertains particularly to
devices connected with the carriage for iron
devices connected with the carriage for iron
the track, and for releasing it automatically
when the burket is rained, also to means con
nected with the carriage for supporting the
bunket while damping, and traveling back on
CENTRIFIGIAL PUMP —J. I. Heath. Alamagordo, New Mex. Ever jumping purposes,

CENTRIFUGAL PUMP — J. L. HIMLD, Alamogordo, Now Mex. For pumping purposes, use is made of a casing provided with a peripheral chamber, a rotor mounted to turn in a casing, deflecting wings on the rotor, and blades or valves mounted to turn with the rotor and adapted to guide the flow of water or liquid to be pumped. The pump Is adapted to operate in either of two directions.

and sepage. It provides a want with a murelated the import The pumping adapted
standing fauge or ridge arranged around the
opening, whereby any surface waters are prevected from dowing into the interior of the
tast.

New Orlean, La. In this pattent the invention
is an improvement in torpedees, shelis, bonnin,
is which may be attached to the observed on the control of the contro

quirs.

WATER PURIFIER FOR ICE MACHINES

-J. J. Schraub, Waco, Texas. This machine is adapted for the purification of write for artificial fee making, but is adapted size for artificial fee making, but is adapted size for interpretation of water for artificial fee making, but is adapted as for artificial fee making, but is adapted as for artificial fee.

The purification of water for a fee feel of the purification of the feel of the f

cleaned INDICATING DEVICE—C N Wienes. Memphis, Tenn An object in this invention is to provide a device which may be manipulated by an operator at a certain station so as to display visible signs for indicating rates and because, thereby dispersing with the uncompared in most brokers offices.

VALVE GRINDER J. Y PORTER, Siights Key, Fia The object of the in-tion shown in the illustration is to provide einder for grinding valves and their seats



having holes therein, one of the holes be deeper than the others, the prongs be adapted to engage the holes in the valve, that the longer prong depends to the bott of the deeper hole and the remaining port extend a distance into the remaining holes

of the deeper hole and the remaining promps extend a delume into the remaining both section depends on the continuity both and the continuity of the continuity of the continuity of the continuity of that the of rotars engine, one private grantly for that the of rotars engine, one private grantly for that the continuity of contin

Hallways and Their Accessories.

RAIL JOINT — J M JORGIVARK, New York,

N Y. The lavestion pertains to rail joints,
the more particular purpose being to provide
at the junction between consensutive rails a
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loudered as if new. See Theorem and H. V. Strakess, Each Chattaneous, Tono. The latent thou in this case is to provide a stock game for rallways and the like, to prevent animal for rallways and the like, to prevent animal form waiting along the trucks and being struck by trains. For the purpose mentioned, use is made of a pittern baving spaced members and protonth montred on a tie, and a picket puttern when one end of the same is moved downwardly.

pratures were see end of the same is moved downwardly.

EMERGENCY SLIDE VALVE ACTUATOR FOR LOCOMOTIVES - F I' RASAMAN, Pitte-ton, Pa. It is a common occurrence for the following the same properties of the seem side valves of a horomotive to break while ray soutr, necessitating long delines incident to ending a messager on foot to the nearest station to relegraph for another regime, or in disconnecting the broken valve and running the regime on one side motive is to be had. This invention overcomes such delays

Pertaining to Recreation,
PIEARVIER RAILWAY, J W. Bouere,
Inschester, Mass. The invention pertains to
an annaement device of the pleasure-railway
type, in which the pleasure-railway
to stilling in a signary
type and the pleasure-railway
to a signary
type and both exciting and fascinating in
operation.

Pertaining to Vehicles.

TIRE MOLLD.—JOSEPH W THROPE. East State Street, Tienton, N J The mold illus-trated herewith is for use in curing and vul-canizing the outer casings of pneumatic tires or the like; and an object of the invention is



to provide a device which will permit a bard cure of the tire casing at the trend, where there is the greatest amount of wen, and which will permit a soft cure at the sides of the cusing, where flexibility is necessary. The device is intended to be officient in operation

NEW BOOKS, RTC.

VILLY'S ARRANOMMENT OF FINGES
PRINTS DESTRUCTION AND THEM
USES. By Frederick A. Brayley. Boston: The Worcetter Press, 1910.
12mo; 118 pp. Price, \$2. BRAYLEY'S

ton: The Workster Press, 1830.

12mo: 118 pp. Price, 8

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mer. 1911. 308 pp; 48 illustrations.
The interruities of delitionalised estimeters are included in the violame before us. The mod flusteed are William Stemens, James Ruchanan Enda, John Erlesson, Fredinand de Lewesjes. Alfed Nobel, 8tt. Henry Bessemer, John Fowler, Niestins Higgsthech, Otto Jutter, minister and with the state of the lives of the main seem well written, and may be regarded as gitting accurate details of the lives of the men discussed flue witten, and may be regarded as gitting accurate details of the lives of the men discussed flue witten, and may be regarded as gitting accurate details of the lives of the new discussion of the lives of the lives of the new discussion of the lives of the lives of the lives of the state of the post forth befuge was as great as that of 81 John Fowler. Allow will firmely, who was probably the greatest English engineer that ever lived, is not made the subject of one of the blographics.

neer that even lived, is not made the subject of one of the blographics

**JITE PAINTS AND PAINTING MATERIALA.*
By W. G. LOUI, C. E. Chicago: The Modern Painter, 1910. 8vo.; 493 pp. The plan on which this book is built commends itself favorably to the reviewer. The first section deals with "the played it test of real with the played it test of the plane of the plane of the plane, and the plane of the plane, and the plane of the plane of the plane, and the plane of the

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INSECTS AND DISEASE By Rennie W.
Doane, A.B. New York Henry Holt
& Co., 1910 227 pp.; 110 illustrations. Price, \$1.50 net.

tions. Price, \$1.50 net.
The subject of preventive modities is one that is effecting world-wide attention loods, as much or into there is headed as such period with the subject. In the little book before us, an excellent attempt has been made to turing together and place in un-tooknell oron the most imposents of the facts and the control of the fact of the subject. In the little book face to any acceptant of the facts after or special papers. The initiants biological relations of the animals and parasitive discussed is gillisted out in clear articles. The concentral of the book are: Cappler 1, Parasitants.

ism and Disease: Chapter II. Bacteria and Protonos: Chapter III. Techs and Mites: Chap-ter IV, How Insects (Yasse of Cetty Disease). Chapter V, House-dies or Typhoid-files: Chap-ter VI, Mosquitose, Chapter VII, Mosquitose and Malaria, Chapter VIII, Mosquitose and Chapter X, Other Disease, Mostly Tropleal, Known or Thought to be Transmitted by Insects.

Known or Thought to be Transmitted by functs.

An Invraoutcrion or Thermony of the control of th

presention

A Manual of Personal Hydene By
American Authors Edited by Walter
L. Pyle, A.M., M.D. Fourth edition.
Philadelphia and London. W. B.
Saunders Company, 1910. 471 pp.,
small 8vo

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Pagos 1-489, plates 1-28, maps 1-3.
Berkeley, California: University of
California Press, 1910, Price, 89

Material for the preparation of this volume is the result of field studies and collections made by the author in nearly all parts of California during the last minateen years, In making collections, the object has been volu-only to gather representative material, but in

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George Männer. By Wilhelm Ostwald.
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Akademische Verlagsgesellschaft,
1910.

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Watson & Viney, Lid., 1911.

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Custim's Single Hydroplane Float

for Aeroplanes
ontinued from page 196. (Contin

a single and entirely different pontoon from those with which he made his first successful water experiments the pre

It was the first time Mr. Curties tried the new pontoon. In fact, the paint was not dry on it when his assistants, includaree army and one navy officer detailed to study aeronautics under him at the San Diego aviation school, launched the apparatus for the initial test.

After making a run of about a half mile to test the balancing quality of his machine on the water's surface, and when he had attained a speed of approximately forty miles an hour, Curtiss ascended easily from the water to a height of 100 feet. He remained aloft two minutes and ten seconds, describing a complete circle about three-quarters of a mile in diameter, and alighted on

the water at the starting point without the semblance of a splash. He glided to within a few feet of the water with his motor at half speed, and then opening the throttle, he flew about 100 yards be fore settling to the surface of the bay.

The new pontoon is a simple, compact shield, and a small hydroplane with which the first successful experiments were made, the apparatus consists of a single pontoon substantially attached to the under supports of the ordinary type of Curtiss biplane. It resembles a flat-bottomed boat covered with canvas to make it waterproof. It is twelve feet long, two feet wide and twelve inches deep. At a distance of three feet from the front end the bottom curves upward forming a sharp bow the full width of th float and on a level with its top same distance from the rear end the top bends downward, both ends being so near the same proportions that either could be used as the bow of the pontoon

The pontoon is fixed beneath the planin such a manner that the weight of the aeroplane with the aviator in his seat is carried slightly to the rear of the center of the float, giving the bow an upward tilt which materially assists the craft in rising from and alighting upon the water The new pontoon weighs fifty pounds, or less than half as much as the apparatus with which the former flights were made

A stick four feet long and three inches wide, to which is attached an inflated rub ber tube, is fixed beneath the extreme end of each lower plane, the purpose being to support it from contact with the water in turning the machine at full speed before ascending

After the experiment Mr. Curtiss stated that he had solved the problem of flying from and alighting upon the water to his entire satisfaction, and with the excep tion of making some provision for baling water from the pontoon in case of leak age, the apparatus will remain the same as the present model, so far as the hydroronlenes now in use ore concerned

Labor Saving by Automobile Power (Continued from page 197)

ompanies have found other uses for the auxiliary power carried by their motor vehicles. In setting poles, pulling wires on pole lines and pulling cales in subway ducts, time is saved and about one-quarter the number of help ers are required as compared with the old methods employing the main strength of human labor. Winch trucks are also used by safe builders and movers, for raising safes to the upper floors of of-fice buildings.

Another application minimizing idle time during the working day is in load ing and unloading by automobile power. The commercial motor vehicle is ex penative in first cost, and requires, in order to realise its superior capacity and officiancy, to be utilised with minimum delay, the comemy and success of the velticle depending on the extent to which

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it can be kept in motion energing a paying load. A below gazables truck on the primary, who, we played by a lumber company to make its offent overlanding to ployed by a lumber company to make its deliveries, consists of the brack proper with two removable bodies and two tend-ing yard wagons. The loading work is ing yard wagons. The chains work is performed by means of the removable body, the chassis being soutped with a special framework and with a pair of shafts running the length of the vehicle on each side. Loading and unleading of lumber up to 41 feet in length is ac-complished by means of a pair of drums on each of the shafts with a winch on one end of the same and ropes passing over rollers; saving from 45 to 90 minutes for each load and enabling the truck to get in and out of the yard very quickly, in its 12 miles-per-h ur delivery pervice. In the operation of this scheme, requiring one man only, one of the bodies is always being leaded while the other is in transit on the truck, and the latter is thus kept busy most of the time during the working day.

Street sweeping and sprinkling auto-

street sweeping and aprinking auto-mobile vehicles are being introduced to replace the ordinary cumbersome horse-drawn vehicles. One motor sweeper, claimed to effect a saving of 35 per cent, has wide steel tires and a 12-horse-nower two-cylinder engine, giving enough power to sweep uphill on any ordinary grade. sed of this machine is 414 miles per hour, as compared with 2 to 214 miles per hour with the best horse-sweeper. It is operated by one man, and sprinkles a water on the pavement shead to lay the dust and then sweeps with a rotary brush and picks up the sweepings, leaving a space only a few inches wide at the curb-side to be cleaned up by the hand method. In the general hauling incident to farm work a three-ton tractor of American make can carry a ordinary form wagons bitched on behind at the same time. Plowing is also done quickly and cheanly, and more easily at the right time (a highly important matter in farm work) with a machine operating three 14-fach plows, which can cover eight to ten acres per day on two gallons of gasoline per acre. The mechanical plow is always ready for work, and makes the farmer independe "soft" or galled teams of horses. Fitted with extension wheel-rims, the machin can be driven over plowed ground, pulling harrows, etc., and doing a surprising amount of work per day. The rim extensions are fitted with pine which cominto action automatically and which prevents slipping when the whe soft ground. The engine is of \$6 horse power, giving a speed of 4 to 15 miles per hour, and the wheel base is 140

The automobile serves a unique purpose in the quick transportation of labor on emergency jobs. The fire depart-ments of several cities employ a roomy gasoline car to hurry firemen from one point in the city to another in order to reinforce any district needing sesistance. The car is equipped with fire extinguish ers and other light apparatus, and has a seat for the Gnief, in front beside the driver, and two lengthwise benches behind for the men. The same idea is car ried out by a Lynn, Mass., gas and electric company in a repair and general line service wagon employed to convey a gang emen from point to point and also fitted to haul poles on trailers hitched on behind. Another time saving proposition is in a commentary and the first form of the matternary of the matternary in cities. Nucle of the time for during the year under pky permits fell ering their routes on foot, and either off 2.75 per cent in comparison with the climbing the pouts which were stapped previous year. This, is the given yield for the purpose) or lowering the lamps minor requisited gradient hoge, these to the street by a tacklet, for saved by the there, has not been an element. The to the country of th saving proposition is in trimming are lamps in cities. Much of the time for

Peak from 1986 T the Nile, is the generally known as succi. For a generally knows as said. The finance of 500 miles the river same through a very swampy country, settingsis is given a 5,000 square, sailes said dangers a; the Stude District. A green drawnant to this territory in the combine distance of fuel of any description; there there is no timber, while coal less to be imported, and the price of their their positions and the price of their tren; commencially averages about \$23 per top. T to the development of the Southen, eince at this point the Nile could not be safely navigated, owing to deine clumps of the grans, detached by floods, gales, and so forth, drifting into and blooking the main channel. The task of clearing the river and keeping the waterway or thus expensive and difficult.

A German diplomatist, however, con-ceived the idea that this grass must possess a certain calorific value, and sug-gested that it might be harvested and converted into a fuel very cheeply, so as to meet the local deficiencies in this Lord Cromer and Sir Reginald Wingate were approached, and the assistance of the Soudanese governmen being secured, a small commission was dispatched to the Sudd District to study the feasibility of the idea on the spot.
Large quantities of the grass were secured and dispatched to Merseburg, in once undertaken to determine how its conversion into fuel might be effected gether with the determination of the calorific value.

As a result, a very simple and inexpensive process has been evolved. The sudd is first dried and then submitted to treatment in a disintegrator, which reduces it almost to the form of powder. The mass is then briquetted. Recently Lord Cromer, Sir Reginald Wingate and a representative of the German and Soudanese governments witnessed a demonstration of the process. The manufac-ture into briquettes occupies only a few minutes, and in the calorific tests that were carried out, it was ascertained that the heating value of the disintegrated sudd is about 60 per cent that of easl, while the density 80 per cent of coal. of the briquette is. The cost of manufacture was found to be so satisfactor to enable the product to be manufactured on the spot in Egypt, to be sold for about

The Soudanese have now granted a facturing piant in the Soudan, and are sasisting the development in a tangible financial manner. The excess of the experiments has provided communical and obstruction, and will solve the local fuel problem to a unique degree. Owing to the expanse of the Budd District, and the immediate availability of unitinited supplies of the raw material, it is anticipated that an important industry in the Soudan may be developed.

THE total of live stock of all times which used the national front ranges during the year under play permits dail

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(12389) R. L. M. says: Will you kindly give an approved type of label for bot-tles for a small chemical laboratory? A. If you do not buy reagent bottles with the names, etc., blown or etched, you can use paper labels

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of convenient size. You can purchase them ready printed at small expense, giving the symbol and name. The annexed cut shows in reduced tacsimile a simple type of label.

reduced facedmile a simple type of label. (12890) B. J. K. anak how to brown iron and steel. A. I. Bissolve in 4 parts of water 2 parts of regardingled from chorded 2 parts of satismony chorde and 1 part of against side. And apply the solution with a gallic side, and apply the solution with a the sile. Repeat this any number of times, severoing to the depth of color which it is desired to produce Wash with water, and dry, and finally rish the articles over with nowell fines and resists modelately to the satisfaction of the side holled linased oil. The metal thus receives a howen this, and resists moisture. The anti-mony chloride should be as little acid as possible 2. A process having this end in view has been recently patented in Germany by Mi A De Meritens. The goods to be browned. has been recently patented in dermany by Mr.

A De Merthem The goods to be browned
form the anode of the hath, which consists of
formed by the wave which consists of
formed by the vessel which consists the water.

If it is made of iron, otherwise, a plate of
form, copper or carbon is plated in the bath.

The water is kept at from 100 to 180 day F.
Glently great to devoupses the water. The
expers which thus is given off at the anode
forms in an hour or two a layer of the black
oxide of iron is continuation of ferrous and
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(18391) C. L. asks how to soften steel.

A. I. Place a quantity of newly burns lime in a damp place, where it will fall in the form of four, put it in an iron hox. Heat the articles to dull red, relean of all scale, and put in lime, and completely cover with lime; cover box over with rom lid and leave until cold. The more lime and arguer the constraint of the control of the cont

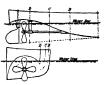
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G₂ = 0.0225 × 5.0 = 0.14225 pound G₂ = 0.00225 × 5.0 = 0.14225 pound G₃ = 0.02255 × 5.0 = 0.2423 pound Thus three weights, divided by the weight of no consistency of the constant of t

(12983) M K W. asks how to platinize silver A Place some platinizum in a small quantity of aqua regin or nitro-muriatic sold, and keep it in a warm place a few days; it will dissolver As soon as it has dissolved, ovaporate the liquid at a gentle heat until it is as thick as honey, so as to get rid of the recess of the nitrie and muriatic acids: Add a little water, and it is ready for see A down drops of this sulting news a long way in platinizing after the control of the ready for see the second of the ready for the ready size of the ready for the ready in t (12393) M K W. asks how to platinize

(12394) W. M. aaks' How many cells would it take to make a 4-inch apark? A battery of six cells, giving 10 roits and 8 amperes, should work a coll which can give a 4 inch spark. (in fiver-passers No. 1527, price ten cents, gives the plans for a 4-inch coll

A thek spark. Unr SUPPLEMENT NO 1937, ptree ton cents, gives the plans for a 4-inch coil of 1935 N. C. H. Writes: When it is desired, in shallow water, to set more power from a single-scree propeller boat, it is customary to equal to twenty the strength of the strength



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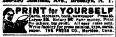


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Electricity

Electricity in China. -- Our Consul in Hong Kong reports that China is ripe for the introduction of electrical ma chinery. However, an educational carr He suggests the im portance of sending engineers to China who can advise upon the subject of in stalling light and power in Chinese cities. There are very few Chinese en sineers who can do such work, and the atter of having a special representative in China would be of untold value to the Chinaman, as well as to the manufacturer of electrical machinery.

Change in the Value of the Volt .-Since the first of the year the National Bureau of Standards has adopted a new value for the standard volt in this cour try to correspond with that in England France and Germany. The change, while numerically very slight, will be felt in the incandescent lamp industries. The ton cell at 20 deg C Heretofore we have rated the cell at 1 091 volts; now the rat ing is 10183 volts. Our volt is hence eight ten-thousandths larger than eretofore

Electrical Exports for 1910. - The Bureau of Statistics has published a re port on the electrical exports for last year, which shows that the total came to that of 1907 Had it not been for the small figures for February and January, a new record would have been made. In 1907 the total exports were \$17,460,775 Last year they amounted to \$17,001,126. While the exports of electrical appliances exceeded the figures for 1907 by about two million, there was a marked drop in the exports of electrical machinery, bringing the total of the year nearly half a million below the record

Sending Telegrams by Telephone.—At ne time when the Bell Telephone Company combined with the Western Union Telegraph Company it was decided to transmit telegraph messages by tele phone, whenever possible, in order to provide quicker service and reduce the cost of using messengers. This plan has not proved as successful as was at first anticipated, owing to the fact that im telegrams were sometimes livered to the wrong persons For this reason, it is reported, the Western Union Company has decided to revert to the old em of transmission by messenger.

The Output of Tungsten in 1969 .-- Ac cording to figures recently published by the Geological Survey, the total produc-tion of tungsten in 1909 was 5,289 short tons of ore, containing 60 per cent of tungsten trioxide. It is believed that the percentage is placed rather low, and that the ore contains more than 60 per cenof tungsten. Of this quantity, 1,619 tone were produced in the United States, 1,200 tons in Australia, 900 tons in Argentina 609 in Portugal, 421 in the United Kingdom, 168 in Bolivia, and 106 in Ger Tungsten has become such a strong rival of tantalum in the incan scent lamp industry that the demand for tantalum is decreasing materially

Diversion of Water from Niagara Falls. -- The Burton Act, which limits the amount of water which may be diverted from Niagara Falls to 15,600 cubic feet per second, expires on June 1st. There-after the waters of Niagara will be in the hands of the Secretary of War. While the Burton limitation will be removed there is still a treaty limitation with Great Britain, permitting only 20,000 cubic feet per second of water to be diverted by the United States, and an equal amount by Canada There is now a measure before the House of Representatives which aims to allow States to divert permanently the entire 20,000 cubic feet per second, and also alms to place no limit upon the amount of electric power that may be trausmitted into this country from Canada. Such a limit was imposed by the Burton bill.

Die

Exploit the America.—A recent editorial in our col-Diesel motor is not receiving commercial ecognition in this country has brought to this office a letter stating that, two or three weeks previous to our comment, a company of leading engineers and financiers had been formed for manufactur-ing and exploiting this engine.

Mesopotamia to Bloom Again.—Bir William Willcox, who has been surveying the ancient country lying between the Tigris and the Euphrates, has obtained contract for the construction of the first dam in the irrigation works which were designed by Sir William Willcox for were designed by Sir William Wilcox for restoring Mesopotamia to its ancient fruitfulness This arid waste, now if-fected by swamps, contains traces of an-cient irrigation canals, and its one-time fertility is a matter of well-substantiated history.

Panama Canal Fair at San Francisco.

-We note that, by a very large majority, the House has chosen San Francisco as he exposition city to celebrate the pletion of the Panama Canal in 1915 Although we consider that these great fairs have been too frequent in the past few years, and have been dominated too much by the spirit of commercialism, we rengratulate San Francisco on its selec tion, and express the hope that the au thorities will make the event what it should be—a great educational influence.

Progress of Work at Panama.-The report of the progress of the work at Pan-ama during December shows that during the month there was completed 1.-88,880 cubic yards of dry excavation and about one million cubic yards of excavation in the wet, making, with excavation for plant, a total for the month of 2,603, 206 cubic yards. As compared with the preceding month, there was an increase of 5,060 cubic yards in the amount of concrete laid, the daily average for the twenty-six working days being 2,085 cubic yards

Proposed Black Sea and Baltic Canal. There is a movement on foot in Russia to build a canal with a minimum depth of 14 feet between the Black Sea and the The total length from Riga to Khersom is 1,336 miles, and on this division for 322 miles the canal will follow the bed of the west Dwina This section is to be followed by 63 miles of en tirely new canal, ending in the river Dnieper. The remaining portion of the canal, for a distance of 1,010 miles, would lie in the bed of the Dnieper. The stimated cost is \$150,000,000

Serious Interurban Car Accidents,— The increase in the size and speed of interurban electric cars has reached a point where there is a demand for a thorough revision and improvement of the methods of operation, and particularly of the system of car dispatching and signaling. The necessity for this is to be found in several shocking collisions which have recently occurred, in which the number of deaths and injuries appr those of the worst steam railroad collisions. Wherever it is possible, inter-urban roads should be double-tracked, and the latest block signal system, or some medification of it, introduced.

To Maintain London as the Leading Port. —In the hope of maintaining Lon don as the leading port of the world, the port authorities propose to spend over seventy million dollars in improving the dock and harbor facilities of the Thames below London. The river channel from Tilbury to London Bridge is to be widened to one thousand feet and deepened to thirty feet, and at Tilbury three new docks of 65, 126 and 138 acres, respectively, are to be constructed, which will be "capable of dealing with any pos growth in the size of vessels for many years to come?" The improvements sexpected to extend ever a period twenty years.





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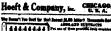
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Torms of Agromantics.— Words Committee of the ciety of Great Britain rea standard list of seronau sy Among others in the following:

A fiying machine support or more propellers, rotating mi er apparently vertical shafts "flapping wing'

er technical words of acro-milisted and properly defined. of to Fly Across the Hudso r an unsuccessful attempt to the Guttenberg race track in ey across the Hudson River to reey across the Hudson River to rik some time ago, which ended follision with a house, Frank the Belgian aviator, made a attempt on the 16th instant. fter he was above the river, at a of 600 feet, his motor stopped and ed quickly to the surface of the He was picked up by a launch, ed, but his Schneider biplane was

British Biplane. —Important e made on January 14th by the tish Army serial authorities of a new e of biplane. The machine is the in-tion of Mr. G. de Haviland, a member the Army Balloon Works' staff It is out the size of the Curtiss biplane. ving planes about 80×5 feet spread, aged 5 feet apart. The single vertical endder is foot-controlled, but the front and rear horizontal rudders and the allerons are all worked by hand. The enthe propeller is mounted on its crank-The test flights, of which three lasted over 20 minutes, and the final one 70, showed a speed of between 25 and 40 miles per hour. Mr de Haviland also made three short flights with a passen

planes and Dirigibles in the French —In his official report made the first of the year, M. Clemental states that France has 32 aeroplanes in use in the army and 34 military aviators to fly them. The biplanes and monoplanes conthem. sist of the following machines: 2 Breguet, 4 Sommer, 4 Maurice Farman, 11 Henry Farman, 5 Wright, 2 Antoinette. and 4 Bleriot. No less than 8 additional Blériot monoplanes underwent tests and taken over during three days the middle of last month, so that France now has 40 military aeroplanes. In time of war she could muster 14 dirigibles besides. The main aeronautic shop and laboratory of the army is at Chalais Mendon, near Paris, while at Vincennes there is an aerodrome where aeropiane are tested and experiments in flying con ducted... A number of smaller establish ments are located at other points, as well as schools for the training of pilots.

Wireless Experiments with Aere planes in America.—During the course of the aviation meet last month at dan Francisco, Lieut. Paul W. Beck of the Bignal Corps went aloft in a Wright biplane piloted by Parmales and trans mitted wireless messages for a considerable distance while at a height of 1,000 feet. These messages were received at the Mare Island navy yard, 40 miles away, as well as at the Yerba Buens Island training school in the bay. In Lient. Beck's experiment a 100-foot length of copper wire was trailed behind the opiane; but in some experiments re tty made in New York by Mr. Hor centry made in New York my mr. and thin, it was tound possible to utilize the gardene instead. In match wireless messages Value last mouth wireless messages beet trainfulted is sittle from an accoming secondary last while in Bogland, while is the secondary is string to the military airmity form of sammy sittle, from Furthers of sammy sittle, from Furthers of Furthers and Cours, the sittle was sittle to tenament head to be set were sittle to tenament head.

Science

New ew Storm Signals ice has been the first the first country to b gin the use of the new international storm signals, described in th TIFIC AMERICAN of January 21st. new system went into effect at French seaports on Japuary 15th.

Molecular Dispersion.—Even the most solid metals lose some of their molecules by dispersion from the surface, but some rious peculiarities are observed in process of molecular dispersion. For instance, when a piece of gold is pressed against a piece of lead, some of the molecules of the former disperse into the lead. The process is, of course, extremely slow and years are required be-fore its effects become evident. But slow as it is, the dispersion of the molecules of gold into a mass of lead takes place faster than into either air or water. The surface molecules of water disperse readily into air, but re fuse to enter oil The molecules of as disperse quickly in water, but refuse to enter air, or most solids, in appreciable quantities.

Initiation Among the Eskimos. --- A de-vice for protecting the lungs and throat from the injurious effects of foul air was found in use among a tribe of Alaska. Eskimos by Capt Jacobsen, in course of his expedition of 1881-1883 This Eskimo respirator is a little basket woven of twisted strands of fine grams It is placed with its hollow side agains the mouth, and a wooden peg, which rises from the center of the basket, is held between the teeth. The respirator protection against the smoke which is evolved in preparing and taking a vapor bath. For this purpose water is evaporated over a hig fire in a very low hut, which is tightly keep in the heat. In this stiffing atmosphere the employment of a respirator is absolutely necessary.

Solid Particles in Human Bres It has hitherto been assumed by physi ologists and hygienists that the exhala tions from the lungs were composed entirely of oxygen, nitrogen, carbon oxide, water vapor and other gases and vapors, without any admixture of solid matter. According to a recent note in Cosmos, Dr. Courtada has examined with the ultra microscope the moisture of the breath, condensed without contamination with atmospheric air, and has found therein a multitude of solid particles, of various shapes and sizes, some mot less, others moving, and presenting the appearance of cocci (globular bacteria) and bacilli (rod-like hacteria). Epiand Dacilli (rod-like nacteria). Effi-thelial cells were also found. A few drops of this molature, evaporated to dryness on a glass plate, left a dusty de-posit nearly as denso as the deposit left by an equal quantity of potable water. No bacterial culture could be obtained, however, although four different culture mediums were tried.

A Service for Agricultural Meteorology.

—It is reported that the French government is about to organize a special service of agricultural meteorology, under the direction of the Ministry of Agriculture, distinct from the general meteorological service, which belongs to the Ministry of Public Instruction. Exactly the same thing has recently occurred in Russia, where the Ministry of Agriculture flow has a meteorological service of its own, distinct from the large and wellorganized service pertaining to the Central Physical Observatory; while some thing analogous exists in Germany, where a few years ago the Prussian Ministry of Agriculture organized a new public wenther service, which is independent of the old meteorological institutes of the German States. There seems to be a well-defined movement in the direction of giving agricultural meteorology an independent status. This plan undoubtedly entails a great deal of duplication of work, and its reigon d'être is hardly



The Truth About Our Civil War

Is it possible for a man to be absolutely fair to both sides of a question? It is doubtful. That is why in every story of the War, North or South has found some grievance. But though the mind of man may be in doubt and the hand of man may waver- the hand of nature is sure-and it is our great good fortune at this day—fifty years after the War began—to have found a story of the Civil War that was written by the sun in the sky on the sensitive plate of a camera.

We have found 3,500 photographs of the Civil War that have been lost for nearly fifty years. We have recovered them from oblivion and now you can own them.

These photographs were taken by the greatest photographer in the country He died in a hospital almsward, long after he had lost this splendid work of his genius. Grant saw these pictures taken—Garfield valued them at \$150,000—the Government of the United States paid \$27,840 for a similar collection. Now, the original negatives are almost priceless—for they are the one vivid, accurate, real story of the War



The Hand of Man and The Hand of Nature

Here is vividly contrasted the work of the hand of man and the work of camera Brady caught this artist from Harper's Weekly as he was sketching a battleheld.

At best this artist could only put in a few strokes of the pen in the few min-utes at his command. He had to draw on his imagination when he finished the picture at leisure.

The camera caught the whole scene in a flashthe developing was done on the spot, as is shown by the photograph of Brady and his improvised dark room in camp. You have seen the work of this Harper's Weekly in old books. Now you can see the truth from

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Not only are they of great historical im-portance, but they will make appropriate additions to your library walls. They show eighteen different aspects of the mighty struggle.

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CEMENT

The MARCH MAGAZINE NUMBER of the SCIENTIFIC AMERICAN ISSUE of MARCH 18th, 1911

¶ Had Aladdin rubbed his wonderful lamp and asked the genius that performed for him the tasks of a steam crane, locomotive, airship, cook, jeweler, glass of fashion, judge of feminine beauty, and universal provider, to supply a material which could be transformed from a powder into a solid, hard as rock—which sculptors could mold as easily as clay, which could mimic the gorgeous marbles and porphyry of the East, and which could be poured like water-perhaps the genius might have been stumped for once.

¶We are going to tell you about such a material in the Scientific American, and it's going to be the story of Cement, the most protean substance in the world, a material with which engineers and architects and

artists have worked wonders.

¶ We cannot but feel that in no magazine has there ever been gathered together a series of articles on the uses of cement which drive home so tellingly the wonderful versatility of a substance, at once one of the oldest and the newest of architectural materials. TEvery article is written by a man who has actually worked in the field which he is describing, and who is, therefore, able to express himself authoritatively on the results achieved.

WHAT THE NUMBER WILL CONTAIN

The Manufacture of Centers.

Thing in a pedagoge strain, so amply worded, however, that a reader who really washe to learn cannot fail the strain of the str to understand the message written. That article will answer the question "What is Portland cement?" In addition, it will answer the questions "Why is it alload Portland cement?" "How is it made?" Mr. E. D. Boyer, a leading cement expert, is the author of the article. Boyer, a leading cement expert, is the autinor or the atturned. He interally transports, you into a cement factory, takes you by the hand and guides you through the plant, and shows, step by step, the processes through which raw rock must pass before you can buy it in the form of a

Cement in Ancient and Modern Times

Like many a new invention, Portland cement is as old as civilization. It remained for the modern enpitch of perfection. Mr. Albert Moyer will contrast the ancient with the modern use of cement, and show the wonderful adaptability of the material

Cement at Panama

If the Panama Locks and the great dams at the lathmus will be concurred.

Introduced enturely of cement, one of the buggest tasks ever undertaken in concrete. Late views of the work at the lathmus will be published which will show the extent to which cement is used in an undertaking dear to the heart of Americans. The article that accompanies the views will present

The Relation of Cost to Supply

In addition to the contributions enumerated, there will be a statistical article which will graphically compare the increase in the use of cement and the corresponding decrease in the price of cement.



The One-Piece House ...

Much has been written of late in magazines and newspapers on the subject of the monolithic cement house. The story of the amazing achievement of casting a house simply by pumping into specual forms liquid material which later becomes as hard as stone, has never been fully told Mr. J. P. H. Perry, who is a well-known authority on the subject, will explain the progress that has been made in this method of building. What is more, he will tell you how far the method in practicable in the light of our present knowledge of cement. There in the light of our present knowledge of cement. There will also be descriptions of other systems of house building with portable forms.

The Problem of Waterproofing

There are many who heatate to employ Portland comment because someone told them it was impossible to make a cement bouse waterproof. It cannot be demand that a difficulty exists. Yet the principal and practically the chief problem to be solved in the construction of foundations which will prevent the seepage of moisture through concrete walls in tully set forth by Mr. Ralph Davson, an expert in waterproofing materials. He gives detailed and practical examples to cover all the situations that may arise.

The Mimicry of Cement

When the ordinary cement block first came into being, its ugly, unin-learning gray surface damned it in the eyes of the artistic. Nowadays we know how to color cement, so that it can assume almost any shade desired, and so that it can duplicate the texture of different colored grantes and other stone. This phase of the subject is ably treated by Mr. Fred Norsia, a leading expert in such work. The article will reveal the artistic possibilities of cement and the illustrations will show how remarkable sculp-possibilities of cement and the illustrations will show how remarkable sculp-

REGULAR SCIENTIFIC AMERICAN FEATURES

All these articles, and others which we hope to publish on the subject of cement, will appear as an addition to the regular Scientific American. There will, for instance, be the usual Aviation page, the abstracts from current periodicals, the Inventor's Department, and those articles which discuss the scientific achievements of the hour and which would naturally find a place in the Scientific American as soon as they are announced.

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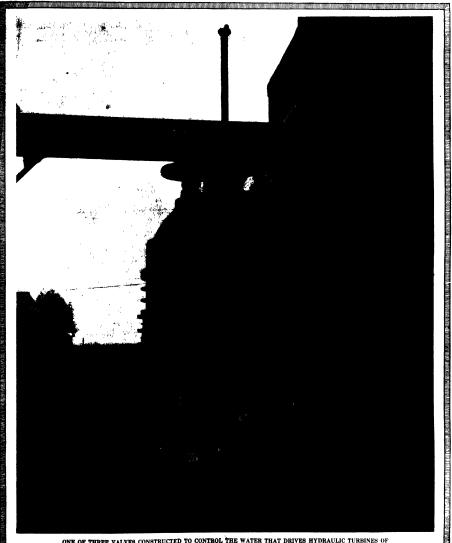
SCENTRIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CIV.

NEW YORK, MARCH 4, 1911

[10 CENTS A COPY



ONE OF THREE VALVES CONSTRUCTED TO CONTROL THE WATER THAT DRIVES HYDRAULIC TURBINES OF 12,000 HORSE-POWER EACH AT NIAGARA FALLS.—[See page 222.]

SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, MARCH 4, 1911

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The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of scurice.

The Panama Canal Must Be Fortified

T the Isthmus of Panama, far removed from the nearest territory of the United States, and surrounded by turbulent governments whose perpetual ferment may cause them to break into hos-thites at very short notice, inaccessible except over lengthy routes by sa., then is being created at a cost of nearly four hundred million dollars, a prop-erty, the Panania Canal, whose completion, it is hoped, will greatly stimulate the oversea trade of this country and the building of an adequate deep-sea in rebant marine, and at the same time greatly increase the strategic value of our may.

It is a peculiar characteristic of this great enter-prise that, in suite of the stime does character of perpetual ferment may cause them to break into hos-

press that, in spite of the stipendous character of its works and the long years that have been needed for its construction, if it were left in an undefended condition it would be capable of quick destruction, or at least of such effective disablement as to be ren-dered useless for an undetermined but very considerable length of time

Common sense and far-sighted prudence demand that, having created this invaluable property, its owners should take measures to ensure its permanence and protect it against destructive attack; and it is the unanimous opinion of both our Army and Navy Deunaminous opinion of both our Army and Navy De-partments, that the most effectual was to protect the canal would be to construct a powerful system of forts commanding the entrances both on the Pacific and Atlantic terminals. During the post few months, much has been said and writen by lavinen, and by a very few multiary men, against the propriety of so detending the canal. Notable among the latter is a retired admiral, the value of whose professional opinion would seem to be decreasing in the exact proportion as the demand for his services as a magazine writer is on the increase. It has been urged, first, that to build defences at the canal would do violence to that policy of neutralizing the canal to which the United States is committed, inasmuch as government would thereby assume a menacing and hostile attitude to the foreign nations that might wish to make use of it, second, that fixed defences at the entrances would not cover the safety of the whole 50-min length of the canal, which, at any point, would be hable to attack by land forces, third, that, since the canal less been built largely for military purposes, it is the province of the may to de-fend the same by stationing its warships at either

It is not the province of this journal to go into the political aspects of the question, and it is suf-ficient to state that the right of the United States to build defensive works, if it should so desire, is clearly recognized by treaty, and that the leading naval and military experts in Europe seem to be agreed that we not only have the right, but that it is altogether expedient, to safeguard this property by suitable fortifications Furthermore, these works would be of a purely protective and not of an actively offensive broads by any of the highly evilized nations

of the carth, there are too many governments, pos-sessed of fleets of no inconsiderable power, whose state of advancement in what might be called the ethical side of human civilization is not such as to eminea side of numan eviriamen is not such as to make it sure that, in eases of extreme provocation, they would hesitate to seize the canal for the sake of obtaming some strong strategic position in a criti-cal phase of hostilities. As to the claim that permanent defences would not

insure the integrity of the whole stretch of the canal, it must be borne in mind that the scheme of defence contemplates, not merely the mounting of high-pow-ered guns at the entrance channels, but the placing of heavy garrisons for the | atrol and protection of the whole stretch of the canal from shore to shore.

As to the contention that the proper way to defend the waterway is to station warships at either end, it is sufficient to state that the value of a fleet of war-ships lies largely in its mobility, and that the policy of tying a certain number of our ships to some parti of ving a certain immer to our sinps to some particular point, and keeping them permanently stationed there, is to rob them of the greater part of their value, It was recently pointed out by Admiral Dewey that guns mounted on board ship are on a sinkable, unsteady platform, that their protection is limited, and that the range-finding devices on board a ship have a very limited range of accuracy. Guns mounted on shore, on the other hand, are placed on an unsinkable and steady platform; and being pro-vided with widely separated range-finding apparatus of extraordinary accuracy, they are, gun for gun, of very much greater value than those mounted on board ship. If our first were being transferred, say from the Pacific to the Atlantic, on emerging from the At-lantic entrance, it would be at a very serious disadvantage were that entrance commanded by a hostile fleet, so drawn up that it could concentrate its fire upon each ship as it passed into the open. Con-ditions at the Atlantic terminus are such that, on both sides of Limon Bay, there are excellent sides for forts well advanced on outlying points. The line joining these sites is 3,000 yards in front of the point where the canal prism reaches a low-water depth sufficient for battleships. Powerful forts at these two points would suffice to keep a hostile fleet to it to twelve thousand yards distant from the canal entrance, and, under their protection, our ships could emerge and form in line of battle, before moving out to engage the enemy. Similar points of vantage are presented at the Pacific terminus of the canal by certain outlying islands that would admirably command

the approaches.
"The general board," says Admiral Dewey, "considers the prime object of fortifications at the Canal Zone is to prevent its occupation by an enemy, and by their existence to enable the fleet, free from solicitude for the safety of the canal, to pursue its legitumate functions, whenever the interests of the country most demand its presence."

Oil Fuel on Ocean Liners

THE uniformly good results obtained whenever oil fuel has been given a properly-arranged test on an ocean-going steamship, have made it ceron an occan-going steamship, have made it cer-tain that some day, and not so very far in the future, oil will take the place of coal as the fuel of the great trans-Atlantic steamships. One remarkable fact in favor of oil fuel is that, in spite of the unusual num-ber of advantages to be derived from the change, there is practically no serious disadvantage. Furthermore, the larger the ship, the more marked are the conveniences and economics attending the change from coal to oil.

Among the frequent studies which have been made of the problem and the many eulogistic articles which have been written in favor of oil fuel, one of the best is an editorial in a recent issue of our Scotthe best is an entional in a recent issue of our Scot-tish contemporary. The Steamship, which briefly summarizes the advantages of oil firing as follows Steady steam pressure, an absence of "dirty" fires, and no necessity for cleaning fires (which has be-cause of the opening of fire doors and cooling off of furnaces, is estimated to cause a loss of 12½ per cent of steam on a 7-day voyage, with a correspond-ing loss of speed), reduction of bunker space to fiveighths of that required for coal, and a great reduction of the force of stokers.

It is pointed out that portions of a ship v now useless for coal bunkers, because of their nar rowness or maccessible position, are always available for the storage of oil fuel. The double bottom may be thus used, and the trim of the ship may be preserved thus used, and the trim of the ship may be preserved by admitting ase water to the empirical of tanks. The objectionable list to port or starboard, due to using more coal from one sade of the ship than the other, as avoided; a steam pump serving to transfer of fuel from sade to side at a moment's call.

Now, in view of the many above advantages, it may be asked why the leading Atlantic steamship

lines have not adopted oil fuel. The the sate that these ships were built in an and that, coupled with the prejudic in the general generace, of ship owners against fixed oil has been the financial objection to the cost of the sate of the necessary changes in the bunkers. As of fact the advantages of oil firing, the relation of fact trans-Atlantic liners, would be quickly realized that we look for its

Our contemporary makes a study of an the "Maurctania" and "Lusitania, very striking way, what oil fuel could do fer these great ships. The average consumption at a sea speed of 25 knots is 5,500 tons of coal for the single w of 25 knots is 5,000 tons of tout for the same of 11,000 tons for the round trip. If all were a 5,300 tons could be stored in the double bottom the ship, leaving the coal bunkers available for on It is estimated that 600 tons of oil would do, in the ship of the same accomplished by tris estimated that 600 tons of oil would do, in system ty-four hours, the work now accomplished by 2,000 tons of coal; and this would represent a saving of about 2,000 tons of fuel on the five-day single stay. age, or of 4,000 tons on the round trip. I age, or or wood some or vacant bunker space, or its equivalent, in a ship of vacant bunker space, or its equivalent, in a ship of similar size and speed, were utilized for freight at \$5.00 per ton, the carning capacity of the ship would be greatly increased. Of the 312 firemen and cond trimmers now carried on the Mauretama, 285% be sent ashore and used in handling the extragenthat would be carried. In place of \$12 firemen, is estimated that 27 greasers would be sufficient to attend to the oil burners and to the water feed of the boilers By alterations of the accommodations now reserved for the 285 firemen and trimmers, it is estimated that at least 200 third-class passenger estimated that at least 200 third-class passengers additional could be carried at \$25 per passengers. An estimate of the total conomics shows that the increased carning capacity of the "Mauretania" on a round ovage from Liverpool to New York and back, would be about \$60,000.

would be about \$60,000.

Lastly, on the important question of speed, it margued that since \$2 \text{ fires out of 192 furnaces in the boiler rooms of the "Manuretania" are cleared every four hours, some 10,000 out of 70,000 horse-power must be bott through that disturbance of the fires and the cooling off of the furnaces which is inseparable from cleaning—all of which is avoided under oil firing. Our contemporary believes that the use of from Cour contemporary believes that the use of oil fuel alone would reduce the time of the voyage between Queenstown and New York by from eight to ten hours. If so, the "Mauretana" might be able

The Self-igniting Oil Engine

OMMENTING upon the advantages of the Diesel motor in one of our last month's issues, we pointed to the apparent neglect which this engine has suffered in our States. We have since received several communications, in which it is urged that the Dicsel system has not been wanting in ap-preciation, and that the motors have been regularly previous and must be motors have been regimery manufactured and put upon the market under a series of patents controlled by a leading St. Louis capital-ist, with such effect that the aggregate horse-power in use at the present day has reached quite a considcrable figure.

In point of fact a manufacturing company of Cudahy, Wisconsin, has in the past been building Diesel motors for the St. Louis interests, and in the future their construction is to be carried on in a spe-cial plant now in project at St. Louis. The Diesel motor has, therefore, not failed altogether to find supporters here. Indeed, some notable improvements in its design are distinctly American introductions such for instance as the use of a long piston in place of the original cross-head, and a skillful modific of the air-compressor, which has greatly simplified the Diesel installation. Nevertheless, it does not appear that the spread of the Diesel has been at all proportionat to its virtues. Its manufacture re-quires special care and attention in the choice of material and in workmanship. While the pains thus bestowed upon the work of production are amply reaid by the great advantages gained, the first c the Direct engme is necessarily somewhat higher than that of a corresponding steam unit of the more common types. The immediate gain derived from the substitution of the Direct in place of steam power depends, of course, in considerable measure on the relative costs of coal and oil. It is largely for this reason that its adoption in Europe, in localities where the price of coal is comparatively high, has pro-gressed with more rapid strides than here. But even the Diesel engine is necessarily somewhat higher under the most favorable conditions, the advantage seems to be on the side of the Diesel; and although, has been pointed out, the aggregate horse-power of the system in this country has risen to a very appreciable figure, the Diesel motor cannot be said to have received its proper share of attention.

Silvanus Philipps Thompson, F.R.S.

The Noted Electrical Engineer and Physicist

By P. F. Mottelay

THE usual series of Christmas lectures at the Royal Institution of Great Britain has this year been di-thered by Prof. S. P. Thompson, whose ratefueld scien-ific investigations and discoveries have carned him a world-wide reputation. The subject which he has chosen for this year's lectures is that of "Sound, Musical and Non-Musical."

world-wide reputation. The subject which he has chosen for this year's lectures is that of "Sound, Musical and Non-Musical."

Prof. Thompson, of whom the accompanying original photograph was especially taken last month for this publication, is a native of York, where he was born, of Quaker parentings, Jaine 19th, 1851. In 1864 the marriage of the properties of the prope

don University, in the organisation of which latter he took a very prominent part. The extraordinary command of languages possessed by Prof Thompson enabled him to personally deliver two admirable foreign fectures—one in Italian on "Mangorie Immorrant of the International Conference of the Santa Conference of the Santa Conference of the Santa Conference of the International Confe

those of 1887 and 1848 before the Institution of Electrical Engineers, one on his telephonic investigations, and the other on the influence machine; of 1898, or rotators converters; of 1905, before the Society of Arts, on high

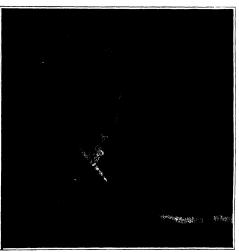
the other on the influence machine; of 1985, on robbots converters; of 1905, before the Sonit yo Arts, on high speed electric machiners, with speed a retrieve to steam trillines, dynamos and alternators, and the trief Krbin lecture delivered at the Institution of Electrical English and the Sonit of the Sonit of the Electron to the original speed of the s

Hers," who invented a telephone, 1860-1863 (1881), "Michael Faracht—Hrs Life and Work" (1891), and he is at present requipt the hein fits of the three years he devoted to the preparation of "The Life to Dard Kerlam," which has just been issued through London publishers. Dr. Thompsom was on oil to find the London publishers. Dr. Thompsom was on oil to founder Culab, organized to the express purpose of rendering into English a work published in 1600 induct the title In-Mannett. It took a very prominent part in the translation, and published an admirable and year valuable series of notes thereon, tollowing them up with numerous lectures on the life and work of the first electronar. To the above he added a translation of the 1809 Epicholo of Closical Companies which he had printed by the great continuous meaning that the long the life of the preparation of the notes, the lectures and numerous articles on these earth writers that followed, Prof. Thompsom was very bortunate in commanding the resources of his profuse private hibrary of electrical literature. His collection of early eithnose, known to the writer of the present article, is, without question, the largest in existence, for surpassing the Romalds and the Latinot Choic hibraries, and only in making the control of the latinot choic hibraries, and only in making the excellence of a surpassing the Romalds and the Latinot Choic hibraries, and only in making the excellence of the present article, is without question, the largest in existence, for surpassing the Romalds and the Latinot Choic hibraries, and only in making the excellence of the properties of the properties of the control of the covered to the surface of the properties of the covered to the surface of the properties of the covered to the surface of the properties of the covered to the surface of the properties of the covered to the surface of the properties of the covered to the surface of the properties of the covered to the surface of the properties of the covered to the surface of the properties

The shigndar versatility of Dr. Thompson is evidenced by his admirable water colors of Alpine mountain glacers and of Camodian scenery, as well as his sketches in black and white, his card illiminations, his ctchings of portraits, among which is one which he prepared with his own hand for his work on Michael Fereday, and his version Michael Fereday, and his Perram translation. The accompaning photograph is an excellent likeness of Professor Silvanus P. Thompson as he appears

Percegnus translation

The accompaning photograph is an evcellent likeness of Professor Silvouse? I Thompson as he appears to the second of the professor silvouse? I thompson as he appears to the second of the professor in the second of the



PROF. SILVANUS PHILIPPS THOMPSON

years, and which appeared in French, German, Italian and Polish. In 1866 be issued the first edition of "Poly-phase Electric Currents and Motors" (second edition, 1896), which was translated into French and German, and during 1867 published a volume on "Light Visible and Invisible". He further wrote "The Life of Philip

The Southernmost Meteorological Station of the World

THE Bulletin of the Mount Weather Observatory publishes a report from Vice Consul-General C 1. Chandler, stationed at Buenos Aires, on the meteorological Chandler, stationed al Buenos Aires, on the meteorological station of the Argentine government at Amound House, Laurie Ialand (Scotis Bay), in the South Orkney group of islands—the southermonts preminently inhabited spot in the entire world, situated in 60 deg, 40 min south latitude, and 44 deg, 39 min west longitude. The station was established by the Scotish Antaretic Expedition, headed by Dr. W. S. Bruce, on the 231 hof March, 1903, and was taken over by the Argentine government on the 21st of February, 1904, since which date the has been administered by the Argentine Ministry of Agriculture, which undistant as staff of four men—three observers and a cook—at this isolated place, the nearest inhabited place to the south pole.

outer world is munitained by an Argentine naval vessel, which, leaving Buenos Aires in January to relieve the staff at that lonely outpool, arrives there after a three weeks vayage, in Pederara, and after a short star returns to Buenos Aires, arriving there in March. Stops are sometimes after the staff of the staff

The Physiology of Marching

THE reputation of Germany as a country where life is regulated as much as possible in accordance with the principles of science is borne out by the regulations of the German military authorities concerning the march-

mg and physical training of troops. The "sphysiology of marching" has been the subject of currid investiga-tion, and the results obtained are taken advantage of to the benefit of the German arms. Among the conclusions reached is that during continuous heavy marching the rations supplied are not sufficient to replace waste of orthodystates, and that a dark vest is required after every three days marching, to enable the body to recover its normal power.

Velocity of Meteors

Velocity of Meteors

A Nomadeur astronomer has divised a simple and ingenous method of measuring the velocity of inchess
or "shouting stars." He photographs the intern through
a wheel with alternate opinion and two partial sectors,
which is monuted in front of the came can divide a form of the inchess
of the international and the control of thread, by
an electric motor, at a rate of from 40 to 50 (volutions)
for infinite The velocity of the interior of trails angles
to the line of sight can be calculated from the International
flux which It races on the photographic plate, when the
speed of the which it races on the photographic plate, when the
speed of the which it races on the photographic plate, when the
open of the control of the control of the deliquity
of the meteors, subtle and consequently gives merely its
transverse, not its actual velocity.

An Automobile Water Tower

New York's Novel Fire Apparatus

By Herbert T. Wade

ONE of the most useful pieces of apparatus for the first department of a large city is the water tower, by means of which a powerful stream of water can be directed into a burning building with striking effect, especially up to a height of 100 feet. An overall length of about 45 feet and a weight of a feet of the strength of the now in a mackine undergoing a thorough and practical text at the hands of the New York Fire Department, which from preliminary reaults seems to meet the situation completely. The water tower, it will be recalled, so far as kength and general arrangement are concerned, so should be a supported to the form a normal horizontal position collapsed for transport it can be raised to stand vertically, and then an extension pipe surmounted with a nosale can be elevated still farther to a height of 35 feet. This nosale is capable of direction from the deck of the truck and several hose lines may be siamesed to feed the shoot pipe so that a powerful stream can describe the stand pipe so that a powerful stream can of the stream of t

whose fifth wheel is proted on a universally jointed platform attached to the chassis. There is a fourchassis. There is a four-cylinder gasloine eagine of 50 borse-power capacity di-rect-connected to an electric generator, from which cur-rent is supplied to four motors, one inclosed in each of the steel disk wheels of the chassis. The sale car-ries the motor and field magnet, which are station-ary, while there is a rotary armature at each extremity of whose shaft are small armature at each extremity of whose shaft are small gear wheels which mesh into large gears on the inner faces of the wheel disks close to the rims of the wheels. Consequently the

power is applied at each of the four wheels, mounted as it is on an individual steering pivot, and this distribution makes control of speed and steering very effective, both front and rear wheels being united into a single steering mechanism. Each motor is rated at three borse-power, but they are capable of standing considerable overload, and thus exerting considerable pulling power. They are entirely inclosed, water proof and dust proof, and fresiles conductors are only required on account of the



The automobile water tower in action

motion of the axies in attering. There is a foot throttile regulating the speed of the engine and the current output, and a foot lever applying powerful band brakes to all the course of the course o

motor.

Hardly had the new machine been tested at the repair shops of the fire department, as here shown, and on the pavements where a speed record in excess of 18 miles an hour was made, or double that of the three-hope beam,

when it was put into active service is try it one. Within 66 hours the water tower than spoipped answered there-slams and served at one service in the control of the contr

the draught that can be handled by three horses.

Such innovations as the new motor apparatus see all in the interest of efficiency and comony, and in the literature of the comparature of the comparature of the steps in the staining to put the New York Fire Department on a motor basis, and thus keep it in the forefront of progress and efficiency. These innovations are of great importance, and are meeting with the enthusiastic approval of firemen of all ranks. The elimination of the horses makes the quarters more comfortable and sanitary, the increased great comparature of the state of the comparature of the modern fremen. And finally the taxpayer is interested in the fact that the new motor apparatus greatly cuts down the coot of maintenance and gives increased fire protection to the community.

The Freezing Point of Oranges

The Freezing Point of Oranges

A SERIES of important and interesting experiments
A has just been carried out in the laboratory of Rollins
College, Winter Park, Fla., by Dr. O. W. Sadder, Jr., for
the purpose of determining the freesing points of the
juices of different varieties of oranges. The juices of the
ordinary orange, tangering, graperfruit and tardiff (Valencia) were tested for this purpose.

In preparing for the test, keerral pieces of each variety
from oranges from different trees were selected, and three
samples from each piece were used for the test. The
temperature made piece were used for the test. The
the mercury went down, readings of the instrument being
tasket every few seconds, and at the moment freesing baguass, the temperature was carefully recorded. The following are the averages of
the repeated testes

Freesing point of the juice of
the ordinary orange, \$1.79 dag. F. Freesing
juice of the ordinary
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the ordinary orange, \$1.79 dag. F. Freesing
juice of the ordinary
freesing point of the juice of
the ordinary orange.

recsing point of the of the tardiff. 91.87



New York's new automobile water tower. On a snewy day it made a month of Element on heur.

A NOVELTY IN PIRE APPARATUS

The Bleriot "Bus"

A Record Passenger-carrying Trip of a New Monoplane

DLERIOT, the dean of the French airmen, has added Bdistinction to bis aircedy distinguished name by building an seroplance of cultry novel construction, in which he has aurpassed all passenger-carrying records for all seroplance, by flying, with cight people aboard, around his aerodrome at Pau, France. The new machine was designed specially for passenger

The new machine was designed specially for passenger carrying, sended with four permanent passenger in was provided with four permanent passenger in the passenger passenger in the passenger passen

To those who are acquainted with the standard Blériot machine, it will be evident at the first glance how wide a departure has been made from that pattern. As was to be expected, the sile and weight have been greatly increased. The main surface has a spread of 42.66 feet, and a general width of 10 feet, the exact total area being 450.2 square feet. A 100-horse house of the same feet of the same

port over the pounds per square foot of surface.

Outside of the main longitudinal frame of the machine, and the system of cushioning the forward wheth, there is nothing big monoplane to remind one of the studied big monoplane to remind one of the studied big monoplane to remind one of the studied and the studied and the studied and the studied and the studied flaps, which are used in the Farnam and other types. The motor is still carried in the studied flaps, which are used in the Farnam and other types. The motor is still carried in main surface, but it has been removed from the front to the rear; and the gasoline tank, which formerly was hung below the pilot's seat, is now rlevated above the engine. The longitudinal frame and the seats for the pilot and passengers are carried at a depth of six or seven feet below the main surface.

are the pitot and passengers are carried at a depth of six or seven feet below the main surface. The most redical change of all, however, the most redical change of all, however, the most redical change of all, however, the pitot of the rear elevating plane. The tail consists move of a large curred rigid surface, measuring about 6 by 15 feet, with a single-vertical rudder carried above (it. the rudder posts and the tail piece being stayed by rigid tubular sevets.

Biferiot, in all his experimental work, has mossessed the inestimable advantage of a measurement of the sevent of the machine. In the sevent of the machine. In main tarface and heavy and powerful motor in their proper relation to the sevent of the machine. In main tarface and heavy and powerful motor in their proper relation to the sevent of the machine. In he main turface is built up of a series of deep, attenty follows, with a single coverzing of fairle lated upon the top chord of a deep and rigid trans, which extends for its full length, and at each panel point of this true is freezed. A sight transple, arranged in a planel sevent measurement of the sevent of the country of the sum of the sevent of the country of the sevent measurement of the sum of the sevent of the sevent of the sevent measurement of the sum of the sevent measurement of the sevent of the sevent measurement of the sevent of the sevent of the sevent of the sevent measurement of the sevent of the seven

onal struts, as clearly shown in the photograph. In the picture showing the eight people that made the record flight, the pilot, Le Martin, is shown in his seat with his left band upon the wheel for controlling the elevating and vertical rudders and the flaps or alterons, and his right hand near the spark and throttle control it will be noticed that the rocking shaft and wheel, with its bell-shaped base, is retained in this machine, as are



Side view of the Bleriot "Bus" which recently carried eight people. Sustaining rface, 430.5 square feet. Weight with passengers, 2,425 pounds.



r-carrying Bieriot monoplane. Note the dihedral Rear view of the new pa-



The 100-horse-power Gnome engine, now placed at the rear of the main plane.



The sight people about the monoplane ready for the trial flight.

THE MARKET MONOPLANE "BUS"

also the spring buffers for cushioning the running wheels

in starting or landing.

Altogether, this must be considered as one of the m Altogether, this must be considered as one of the most interesting acroplanes that has been brought out for many months past. In its initial test, on February 2nd, Le Martin carried his wife and sax other passengers and circled the Biériot acrostoure at Pau for cight minutes. The fact that Biériot expects to carry as namy as eleven people in the near future shows that this are across that the contraction of the property of the

Capt. Bellenger's Flight from Paris to Bordeaux and Pau

THE particulars which have just been received regarding Captain Bellenger's wonderful cross-country flight from Paris to Bordeaux (923 miles) in 8 hours 28 min-This particulars which have just been received regarding Capitan Belleuger's procession received regarding Capitan Belleuger's to to Bordeaux (328 miles) in 8 hours with subsequent procession of the second procession of t

Zurech could have been reached in Switzerland, Geronbie in the southesst of France,
or Brest in the west
At the same invent flight, Licota Monarch, and the same invent flight, Licota Monarch, in response to a telegram from the
Minister of War, left Cholmos camp with
Capth. Camine as passenger and headed
for Satory, near Versailles, and about 125
miles away. The start was made at 940
A, 22, and although the temperature was
several degrees below freezing, the lindinant sent his Parman hiplane to a hight of 3,000 freet and only more or twofree on the same of the same o

Conneau, De Rose, Masherhe, and T-feormot fiew 63 miles across country from Pau to Psydo on their Biérott monoplanes. They turned at a height of 5,000 feet, and three of them returned without mishap. Con-neau's fuel gave out at Orthey, and In a forced descent he damaged his propeller and chassis. He was able to complete the return Journey the next day, however.

Observations Among the Workshops of Europe—II

Practical Hints for the Extension of Our Machinery Trade

By Capt. G. L. Carden, U. S. Revenue Cutter Service (Concluded from Scientific American, February 25th, 1911, Page 198.)

(The value of the Buropean market as an outlet for American trade has increased republy during the past fee years. With a view to secercising readitions in the muchinery trade, the United States government reveally sent Cost trade, the United States government reveally sent Cost trade, the United States government reveally sent Cost trade, the Cost of the Cost of

In general terms, the cheapest work in Europe is the beautiful the second in Belgium is to industrial labor-saving machinery wherever possible. The Medicte works of practice, in Medicate works the time of the St. Louis Exposition and upon his return equipped his works with the most up-to-date American automatic machine tools. The Medicte works are engaged in the manufacture of cream separators. This calls for most exact work and is largely of the series installations of machine tools to be found on the Continuent of Foursey, and practically all the workmen in the neighborhood, the majority of whom have had little or no previous shop experience.

In Liegg, Belgium, it is possible to purchase firearms probably cheaper than anywhere else in the world. Most of the work on these Belgian firearms hereformed in the hones of the workmen. It is no uncommon sight to see boys, and even girls, on the streets of Liege carrying hundles of firearm mechanism to be worked up at their homes. A Belgian workman to the worked to the seed of the fore work for wor or three hours at a right on some of this freammaterial.

Notwithstanding the low wages paid, the new Pleper of the proper was the seed of the

on returning from his day labors will often work for two or three hours at night on some of this finearm material.

Notwithstanding the low wages paid, the new Pleper Works, near Liége, which undertake exclusively the middle of the least o

pt. G. I.. Carden, U. S. Keveniue Cutterchilded from Scienterica Mariacas, February 20th, 1911, Page
childed from Scienterica Mariacas, February 20th, 1911, Page
American plants, but it approximates very closely to
the qived of the average American works.
The Sementoff Works of St. Petersburg contain many
high-grade American machine tools of medium sizes.
This plant is engaged in the manufacture of machine
tools and cigarette and cigarette tube-making machinery. At the Sementoff shops the workmen are suppilled with complete drawings of all parts, and the
manufacturing methods followed are patterned largely
after those in vogue in the best American plants.
Here I found that the chief of the drawing size,
for each piece, standard drawing size, and standard
intervings based on the Devey decimal classification.
It is not common to find jigs in very much use in
European shops; this is largely because of diversified
manufacture and also because European builders will
undertake to build to special requirements of the purchaser. At the Sementoff shops, however, jigs are used
extensively. Here I found that the Crucible Steel
Company of the United States is aupplying material
for the manufacture of cigarette-making inachines.
This crucible steel, which is declared to be better than
German steel because of its softness, is employed for
this crucible steel, which is declared to be better than
German steel because of its softness, is employed for
Russis typically is able to accure, for the most part, all
material required for machinery work in her own territory.
In the two countries of Domarak and Holland there
is a marked disadvantage under which the machinery
builders labor. Demmark, for example, is devoid of
ore and coal. The same statement applies to Seandinavia in general. There is some coal in Sweden,
but it is reserved largely for the use of the warships.
Practically all material for machinery work in Denmark is imported from Germany. This means that
duration margins in their draps of the manufacture of
t

ernment Ammunition Works. All these firms are located in Copenhagen a similar condition exists as in Denmark, that is to say, the Danish plants are dependent on Germany or England for raw material.

On the occasion of my visit to the Netherlands Machine Works in Anneterdam, I learned that there rough turned, for 30 make; (86.10) per on. The quotation came from the Witkowitz Works of Moravina. The quotation was regarded by the Anneterdam Works as extremely low. The coal used in the Netherlands comes largely from Germany. In 1909, the quotations were approximately \$2.68 per ton.

In some of the Netherlands works the Westphalian coal is regarded as superior to the English eastroast coal, and although it cost a fittle more, it is said that it yields more economical results. In the Amsterdam shops lathe men, planer hands, and milling machine men are paid from 9.3 to 13 cents per hour; boring mill hands receive from 8 to 11 cents per hour; and grinding-machine men 10.4 cents. Twelve

cents per hour is the maximum paid the assembling-department hands. Molders and carpenders get 104. The hours of work are from 7 A. M. to 19 nous, and from 120 P. M. to 6 P. M., except Saburday, when work stops at 1930 P. M.

As an instance of the readiness of foreign plants to buy the latest equipment obtainable in Agerica, the writer observed at the Florisdorf Locondetive Works near Vienna an American milling mackine of Cincinnati make, which, it is understood, was one of the first tools of the type put on the market. The American tool cost considerably more than the standard German machine of similar design, but the former was purchased by the Florisdorf Works because of its apperior medi.

The writer unde every effort to ascertain what produces the standard Cernan machine tools. Inquirtes in this direction were largely directed to those who actually used the machines in the shops. Not a few abopsens were of the opinion that too much cast iron is used in levers and wheels; that not enough attention is paid to bearings; that very often the chaspest grade of white metal is used, and, in consequence, the bearings vian out very quickly. Attention was called to the fact that in some instances shafts were found running direct in the cast iron of loose pulleys of constraints without being lined with breas. Still another criticism is, that main spindles often are not ground and hardened and that not enough attention has been paid for taking side pressure.

The writer is convinced that the criticisms do not

shafts without being lined with brass. Still another criticism is, that main spindles often are not ground and hardened and that not enough attention has been paid for taking side pressure.

The writer is convinced that the criticisms do not apply to the best grades of American tools, and that, for the most part, complaints are either trivial in character or the importance has been enagerasted to the control of the control

It must be borne in mind that ships It must be notes in mind that supments to Europe in-volve considerable time, and misunderstandings which may arise cannot be adjusted in a few days' time. The best Américan machine tools and all new and special tools, possessing mgeft rather than mere ingenuity, will always flad a market in Europe.

The Largest Electric Valve in the World By Frank C. Perkins

In these days of commercial and technical achievement on a gigantic scale, there is hardly any department of the applied sciences which does not boast of some stupendous example, some meanmoth structure, an imposing mounment to the industrial civilization of our time. One thing leads on to another. If the vest strength of Niagara has been taped by water-power stations of unprecedented magnitude, the immensity of the thing extends down into what one hesitates to call the "detail" structures. For a valve which comfortably accummodates an automobile with five persons in its interior is rather a large "detail".

This nine-front valve which to the commodate of the c N these days of commercial and technical achiever

"detail." This nine-foot valve, which is shown on the front page, was designed and built at Indian Orchard, Mass. It is off of a set of three constructed to control the water driving hydraulic turbines of 18,000 horse-power cach at the Nagara Falls Hydreelscitic Station of the

Ontario Power Company. The valves are of the Chaiman type, weighing 63 tons apiece. Each is operated by an alternating current electric motor of 15 horse-power, three minutes being required for raising or lowering that gate, which are of cast steel. They are the largest electric wide and over 50 seek high the total thickness over the finance being nearly? Fort.

It may be stated that the body of the valve is of cast iron, and the valve gate, which is of steel, is designed for a pressure of designating or opining the valve, is ideal of more than the state of the steel of the steel is designed for a pressure of designating then closing or opining the valve, is idealed of more than the steel of the steel is designed for a consideration of the steel is designed for the steel is the steel of the steel of the steel is the steel of the water pressure belding the gate shut the tightly. It is stated that this fand seeding upon the beautiful in the steel of the steel is steel the steel is steel to the steel of the steel is steel in the steel in the steel in the steel is steel in the steel in the steel in the steel in the steel is steel in the steel in the

obtained by putting the seat in on an angle, giving the effect of an ordinary gate valve with wedge-shape dub. The cast-iron valve bedies are heavily ribbed to withstand the high presure, and the brone valve seats are held in the body by bronse headless acreers through the stop face. The seat of the body by bronse headless acreers through the stop seat of the seat

B. Barrier

Correspondence

A Test for Vanadium

A Test for Vanadium

To the Editor of the Schurrura Arenacari
Having had some little difficulty in making rapid
determinations of cessediess ores by the methods that
have come to my notice, and never laving seen the
folioring might be of interest to some of your readers.
Pound my he ore, and fase it with shout equal
wright; of cesselfs sodd in a porcelain crucible. Cool,
and then hold the crucible and contexts in some water,
prefereity creating first, but this is not necessary, and
estage "the crucible and contexts in some water,
prefereity creating first, but this is not necessary, and
estage "the crucible and contexts in some water,
prefereity creating fast, but this is not necessary, and
estage "the crucible and contexts in some water,
prefereity creating a second of the context of the constantial context in the context of the context of the
Add ferror-yande of potassium, and the presence of
randium is readily shown by a focculent apple greater
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A Geometrical Problem Attacked

A Geometrical Problem Attacked

To the Editor of the Scurstrica Assucast;
With reference to a copy of your honored journal
of 9th July, 1901. I noticed, on page 87 in the correspondence column, a geometrical problem set forth by
Mr. Herman I. Schlumpf, where he thirds he has found
a new way of dividing a line of determined length into
any number of equal parts.

As I have not noticed any correction of the new
proposition propounded in any of the subsequent numhers of the Schurzuro Arasaccas, I am induced to draw
your attention to the absurdity and impossibility of
Mr. Schimpf's scheme.

Had his statement been correct, then the long sought

na. Commpus scenes.

Had his statement been correct, then the long sought for solution of the problem of equal trisection of any angle would have been found.

R. Tzt. Spörger.

Solar Energy

Solar Energy
To the Editor of the Scientific Astronomy.

I was much interested in the Peasenden scheme for trillings much interested in the Peasenden scheme for trillings much interested in the Peasenden scheme for trillings and the scheme for trillings and the scheme for trillings and the scheme for the

10 M.
Now on page 53 of Archenius's "Worlds in the Making" we read: "Langley made an experiment with a box, which he packed with cotton would to reduce loss by relationt, and which he provided, on the side turned toward

the sun, with a double glass pane. He observed that the sunspecture rows to 115 dag. (285 dag. F.), while the cherescenter only marked it dag. or 15 dag. (37 dag. (3

4,900 meters (18,789 feet), on September 9th, 1861, at 1 hr. 4 min. P. M. and therefore at a particularly intense solar radiation."

Every competent physicist, in fact, well knows that the temperature to which a body will rise when exposed to radiation of any sort depends merely upon the ballow of the solar properties of the solar ways, but opaque to long ones Langley used merely a double glass plane, but there are other substances much better adapted to the purpose. Nor is cotton wood the best insulator. Langley's was decidedly a cough experiment, a mere side issue in a decided of the solar properties of temperature solar properties of the solar properties of temperature solar properties of the contrary novelthanding.

There is a widespread popular fallacy closely connected with this question, which it may be useful to mention here, via, that the sunlight has a definite temperature that such an instrument will indicate depends entirely upon the nature of the instrument. Different thermometers under above the temperature that such an instrument will indicate depends entirely upon the nature of the instrument. Different thermometers the such an instrument will indicate depends entirely upon the nature of the instrument. Different thermometers likewise the company of the sunlight rise, though everything clee remains the sunlight the health of contrading the temperature at which the healt lost or radiated away equals that absorbed, and has nothing to do with the temperature in the sun. The latter expression has no meaning.

Waterville, Maine.

tter expression has no meaning.

F. MOTT SMITH

The Need for Standard Wire Gages

o the Editor of the SCIENTIFIC AMERICAN:
The item in the SCIENTIFIC AMERICAN of February 11th, page 13, regarding wire gages, touches an important matter. The present confusion in wire gage sizes should not have been tolerated for so many years, but it is not been tolerated for so many years, but it is not

page 16, regarding wire gages, touches an important matter. The present confusion in wire gage axes should too late to apply a wendey.

The following facts, explaining some of the points involved, will, I trust be of sufficient interest to obtain space in your columns.

The use of so many different gages is one of the most annoying perplexities in the wire and sheet-metal business. There are no less than five different gages in common use in the wire and sheet-metal trades in the United States, not to mention the English Imperial standard gage, acrew gage, etc. For instance, a customer may order a lot of springs of No. 10 gage wire, of course not thinking it necessary to mention what gage to curse not thinking it necessary to mention what gage by telepathy or by some other intuitive method: As a result, the aprings might be made of any one of the following states of wire: Am. or B. & S. gage, 0.10186; Stubs steel wire, 0.101; U. S. sheet gage, 0.1406; and if music wire gages are included, 0.086, 0.034 or 0.0386.

To obviate this difficulty as much as possible, most spring makers have adopted the W. & M. gage, and use if for all steel wire springs (except those of music wire), when no gage is mentioned.

The Brown & Sharpe gage, or the American gage, in the standard gage adopted by makers of breas wire and the standard agge adopted by makers of breas wire and the standard agge adopted by makers of breas wire and the standard agge adopted by makers of breas wire and the standard agge adopted by makers of breas wire heing still drawn to Birmingham gage.

In England this same contoun onbained for years to a much greater extent than in the United States, no less than forty-free different gages having been used to measure wire. (For a full discussion of the gage question in England see Wire, Its Manufacture and Uses,' by J. Brecksall Smith, C.E., pages 135-131.) This condition caused the matter to be taken up by the manufacturers,

which resulted in the formal adoption by the law of the "Imperial standard wire gage." While the Imperial agage is the only legal wire gage in Regland, yet some manufacturers still use the Birmingham gage.

In the United States no successful effort has been made toward the adoption of any standard gage for wire. Sheet makers have a shundard gage, Congress having adopted the "U. S standard gage for sheet and plate rows and acted" on March '941, 1883.

wire. Sheet makers have a standard gage, Congress having adopted the "U. S standard gage for sheet and plate iron and steel" on March 3rd, 1883.

The Brown & Sharpe gage is generally used for brass sheet and wire. Birminghum or Nuis. Brown & Sharpe, and Washburn & Mone gage for iron and steel wire, and all of the above gages the size decreases as the number increases, for instance, No. 5 is smaller than No. 6. In music wire and screw gages the reverse is true. Even in masic wire there is no uniformity, the several gages used by English, German and American makers showing considerable variation.

The refluencest to will be sufficiently and the several gages used by English, German and American makers showing considerable variation.

The refluencest to will built and the continuation of the relative desirability of the different gages as a standard for all kinds of wire, so as to avoid the confusion and loss often caused by the present conditions.

A simple and effectual remedy has been proposed, vis., to use the micrometer alone for gaging wire. When asses are expressed in decimals there is no contusion, 0.000 as to the confusion of the standard or and the standard or regular for convenience in dawing wire and to avoid a multiplicity of siese. This arrangement would do away with all half and quarter siese, which are sometimes the cause of misunderstanding at present. For instance, the writer has often found a great lack of assurance as the cause of misunderstanding at present. For instance, the writer has often found a great lack of nearest machine, the change land in a contract of the cause of misunderstanding at present. For instance, the writer has often found a great lack of nearest meeting the change land in nonneculature.

F. E. WHITTEREY, Secretary and Treasurer Raymond Mig. Co., Corry, Pa.

The Nantucket Windmill

To the Editor of the Scientific American article on Naturcket's amount with a power of January 20th appears an article on Naturcket's amount windfull, by Allen Day. While the article is excellent in many ways and very interesting to the average reader, in that it deals with a business of the historic past. I fear it conveys a false impression, and corries with it the interesse that the mild is still in opera-

tion.

As a matter of fact, the mill has not ground any corn for a quarter of a century; and although its mechanism, which the SULFATING AMERICAN 50 Milly describes, is complete, it would not be feasible nor safe for the mill to be started without the expenditure of quilt a large sum of money in making repairs, and replacing badly worn parts.

to be started without the expenditure of quite a large sum of money in making repuls, and replacing badly worn parts

The last miller was an old Portugese named John Francis Sylvia, and he had for an assistant the late Peter Hoy, a veteran of the civil war who died last summer. While the mill was actually operated by Sylvia up to the early 80%, the business which it once had was gone long before that period, and the last time its big who was not before the period, and the last time its big softens Sylvia's death, when a couple of bushels, were carried to the mill and ground into meal, which was then sold in small paper bags at ten ceuts each, for souvenirs. I doubt very much if any of those little lags of meal are in bedign to-day; if so, they have historic value, as the meal is actually the last ever ground by Nantucket's old midneill.

The old landmark is now owned by the Nantucket Hatorical Association, which opens it each summer as a sort of museum. Whether its vancs will ever be set in motion again is very doubtful, but it is assured that the mill and its peculiar mechanism will remain intact for many years to come.

Harry B. Turners.

Wanted: A Trimming Machine for Paper Hangers

O BRERVE a paper hanger on a job calling for good more and you will solve him paste the paper, then fold it upon itself, pasted surfaces State. Then presently a designal stede furnity surface State. Then presently a designal stede furnity surface State. Then presently a designal stede furnity surface state. Then presently a state of the strip; on in paper hanger/ partained, trian the paper, Fugury of a chang praise in respectity thinmed by samethre in the shops before leading shade to the job and hopes; the paste is applied. The white the writer of the notes was at a loss to understand why it was not believe in thin, the paper by machine, as it seemed it could it medicine out more accurately than by Sand. A first medicine out more accurately than by Sand. A first medicine out more accurately than by Sand. A first medicine out more accurately than by Sand. A first medicine out more accurately than by Sand. A first state of the same of the sa

The Current Supplement

The Current Supplement
THE reasonable use of materials in the construction of
Automobiles is the subject of the opening articles of
the current Sirversaners, No. 1835. The author of the
article, Mr. Henry Souther, makes a particular point of
ticsusing the selection and treatment of alloy steels.—
Charles Jaain writes on the gold dredging industry, and
points out its limitations and its possibilities.—The
famous astronomical clock of Venice is described by
Mr. Charles A. Bessaler in an illustrated article—Ethel
Claire Randail writes interestingly on the pyrmy people
of Africa.—The eminent Dutch physicist. Fro. 7 %
of the Washa, who have recently or the property people
of Mr. J. A. Hardonshi dissources interestingly or migrating stear, with particular reference to modern star drift
theory.—Dr. E. F. P. Philipp' damirable monograph on
making money out of bees is concluded.

Perfume Statistics from a Botanist

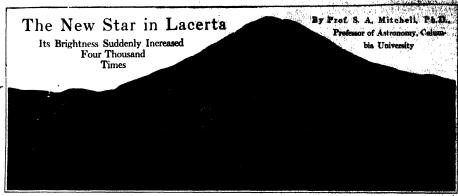
QCORDING to the investigations of a German botan-lat, out of forty-three hundred species of flowers cul-ted in Europe only four hundred and twenty possess agreeable perfuse. Flowers with white or cream-

colored petals, we are told, are more frequently odor-ferous than others. Next in order come the yellow flowers, then the red, after them the blue, and finally the violet, whereof only thirteen varieties out of three hundred and eight give off a pleasing perfume. In the whole list, as compiled by this authority, thirty-three hundred and eighty varieties are offensive in odor, and twenty-three hundred have no perceptible small, either good or bad.

Catgut from Silkworms

Catgut from Silkworms
DROBABLY but a small perentage of the februane.

Who use files atrung with fine transfurent "out-gut" are aware that the almost unbreakable substance that holds the hooks against the flerest struggles of the struck file comes from silkworms. The principal center of the manufacture of this kind of cat-gut is the island of Procedia. In the Bay of Naples, but most of the silkworms employed are raised near Torre Annuniata, at the foot of Veagrals. The caterplifare are killed just as they are about to begin the spinning of cocoms, the silk glands are removed and subjected to a process of pickling, which is a secret of the trade, and afterward the threads are carefully drawn out by failted workers, mostly women. The length of the thread varies from a foot to nearly treaty indicate.



The Harvard College station at Arequipa, Peru.

THERE is no science which shows the wonderful power of the human latellect as well as does actioning; there is no branch of astronomy, we full of strange surprises as the study of the light-variations of states. Some of these changes are of everyday occurrence, which may be predicted with the accuracy of an eclipse; some change irregulary and at long intervals; while some seem to concentrate their whole life into one amaning outburst, where in a few days or hours a star's light is suddenly increased at thousand, or even thousand fold. Stars which blase forth so quickly are called "new" stars, or "nowe," and interest in them has been lately much aroused by the discovery of no leas than four in the last three months of the year just passed.

passed.

Of these four the most interesting is the one in the constellation of Lacerta, discovered by the Rev. T. E. Beplin of Dunham, England, on December 90th, 1910. This star, now known as Nova Lacerta, is found in the Milly Way, between the constellations of Cassiopeta and Cygnus, and forms the apex of a small equiliteral triangles with the sters of g and a Lacertw on the edge of the star of the

Since the beginning of astronomy, only 36 new stars al-

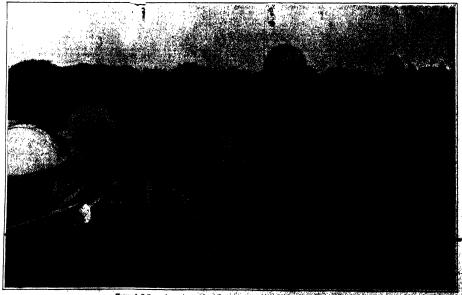
The Harvard College station at Arequips, Peru. together have been discovered of which number exactly one-haif were discovered up to the year 1885. The first one-haif were discovered up to the year 1885. The first of the State of the State

star in Lacerta not found on the star charts, and on examining it with a small spectroscope he found a peculiar spectrum of bright lines. Thinking he land discovered a rather unusual variable star, the news was telegraphed to the Greenwich observatory, who in turn cabled to the Harvard College observatory. Prof. Pickering, on looking into his splendful storehouse of plates, found that the star did not appear on a photograph takem on November 19th, but on November Sird the star was of the fifth of the star was of the fifth of the star was of the star was of the fifth on the won, for it was of the seventh magnitude when first observed by him. An examination of plates taken by Prof. Barnard, of Yerkes observatory, and Prof. Max Wolf, of Germany, shows that the new star had been previously photographed by these enlient astronomers; as early as 1988 by Prof. Barnard, when it was of the fourteenth magnitude. Between the 18th and 88rd of November, the star increased its brilliancy 4,000-5,014.

As long as astronomers had merely the changes in the star's light to guide them, no astifactory theories for the star increased its brilliancy 4,000-5,014.

As long as astronomers had merely the changes in the star's light to guide them, no astifactory theories for the star increased its brilliancy 4,000-5,014.

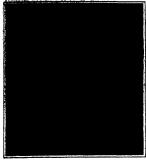
They were able to describe the facts, but could be suffered on a photographic plate, there was necessary a star of some brilliancy, and it was not till the outburst of Nova



Harvard College observatory, where fourteen "new" Mari NEW STARS AND THURS, MEANING

ry test of spectroso

incided by mean. We we recommend the substitution of the born record in the substitution of the born record in the substitution of the substitution of the substitution of the substitution. Findingspatial plates being then consulted, it from the substitution of the substitution. Findingspatial plates being then consulted, it from the substitution is substituted by the substitution of the substitution of



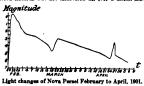
Nebulcaity about Nova Persei September 20, 1901. After a photograph made at Yerkes observatory.

Medicalety shouth for a Persel Reptember 20, 1901.
After a phetograph made at Yarkes observatory.

Immediately applied to Nova Aurigar showed startling peculiarities. The spectrum was seen to biase with bright lines, those of the hydrogen series and belium at being most complexous. Most of the bright lines have had dark companions on their voice side in the complex of the desired of the complexous. How the complex of the c

the occasional success attached diagram, attached diagram, at legt was a brilliant star on which it was possessed theories. And what curious remains a constant of the constan Last was a betillant stor on which it was pos-nic spatianeously theories. An other curious re-gardanceously greated! To begin with the Jish always the ordinary Orien type with Shanes's hydrogen and helium. According to a much is appearing marks at an in a carry insufacionent. The new star then appeared him. On, the day following the insulants of Feb-haneously than the contract of the prectrum was raised insulantly designed. Softly then to we pro-lated the contract of the prectrum was

peared, the same apsetrum was seen as in Nova Aurignarith the bright lines accompanied on their violet sides with dark companions. On the saumption of bright and dark star soliking, the impact would have been at the rate of 1,000 miles per second! Such an impact might occur once-though the chances are many against it—but for such impacts to keep on recurring, and at such terrife speeds, is clearly inadmissible. Some other explanation must be found. The appearance of the brilliant on the found. The appearance of the brilliant on the found. The star gradually became less red as the days passed, and as the star diminished in brilliancy. The spectrum was likewise modified as the star declined. The dark lines became less prominent, and two weeks after the most brilliant, period, had disappeared altogether. The bright lines now shone without dark companions. There into the star gradually changed in appearance, some of the lines period of the star of the star



Hr Spectrum (negative) of Nova Lacertes. Taken January 3, 1911, by Frost, at Yerkes observatory.

4640 Hβ

on December 80th, 1910, when its light was on the decline. A spectrum was obtained at the Yerkes observatory by the director, Prof. Frust, on January 784, 1911, by means of the spectrograph attached to the great 40-inch leiezope. This spectrum reproduced above shows the bright hydrogen lines Ha Hy and Hg with dark lines on the light or violet side. This spectare with the harned band at wave length 4840 is exactly analogous to that observed in the case of Nova Auriga and Nova that observed in the case of Nova Auriga and Nova Barrand, using the 40-inch visually, found that at the principal focus of the great lens the Nova was of a whittin color with crimson glow around it, which agreed essentially in appearance with an ordinary star. One-third of an inch farther from the object glass appears a

beautiful crimson image of the star, as sharp as the first one, surrounded by a greenish bulo. This appearance noted before by Barnard, in another new star, Nova Geninorum, is caused by the concentration of the crim-son light from the red line of hydrogen. The exact position of Nova Locette is 22 hrs. 30 min 1179 sec, and 39 deg. 13 min. 1985 sec, north.

The most notable features of the new stars are as

onlows:

1. Three have appeared in nebular, and all, with but one exception (Nova Coronar) have appeared in the Milky Way.



Changes in nebulosity of Nova Persel apparent on November 13, 1901. 01. From photograph taken at Yerkes observatory.

2. The stars are all very remote since they show no

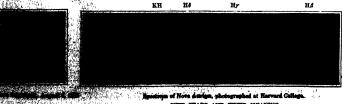
9. They quickly rise from obscurity and slowly sink back again to obscurity.

4. They show first the spectrum of a star in its first stages of development.

6. They show first the spectrum.
5. Then appears the spectrum something like that of the solar chromosphere with bright hydrogen helium lines with dark lines on the side of shorter wave-lengths.
6. The color of a new star is first blinkly white, then red, slowly changing to orange and then to blue or white. The spectrum changes in character till it becomes that displayed by a planetary nebula.
8. In Nova Persei, a nebula became successively ll-luminated.

1. The spectrum enlarges in character this the recomes that displayed by a planetary nebula. It is a substitution of the property of the prop

comes auddenly luminous and exhibits the bright line spectrum. As soon as it has passed through the densext parts of the nebula its light begins to wane, and con-tinues to decline except when the slar encountries some outlying small portions of the nebuls, when the star sud-denly brightness up for a short time. Truly "one star different from smaller in glory," and great is the human hight data can unravel those strange great is the numan high that can unravel those strange



H8

sisteem of Nova Aurism, shotographed at Harvard College. NEW STARS AND THEIR MEANING



Nova Sagittarii, August 16, 1899,

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

Carriers of Piague

Carriers of Piague

ECHNICALLY any animal is a carrier of plague which has piague, and in the organs or blood of which the plague bealing seades. In that sense the natives of India are plague carriers; the relat and bandroots of India are plague carriers; the relat and bandroots of India are plague carriers and the control of the plague bealing that the instances in which a rat saffering from plague could inoculote man with plague bacilli most but rue carriers of plague are the animals which convey the bacilli from rat to rst, or from rat to man, or, in rare instances, from man to rat. These animals are the fleas which infost rats. This conclusion, apparently so simple, was, however, not rached without long continued investigations, undertaken, at the instance of the Indian government, the area of the Indian government, the rate of the Indian government, in the Indian Col. David Bruce, F.R.S., which has been at work since 1904. The results of that commission's work are summarized by E. S. Grew in Knowledge. Among the investigations made by the Plague Commission have been a number which dispose of the idea that plague can ordinarily be spread by plague bettli which may be left on the control of the idea that plague can ordinarily be spread by plague bettli which may be left on the control of the idea that plague can ordinarily be spread by plague bettli which may be left on the control of the idea that plague commission have been a manber which dispose of the idea that plague commission have been a manber which dispose of the idea that plague commission have been a manber which dispose of the idea that plague commission have been a manber which dispose of the idea that plague can ordinarily be streament to the relative to the control of the control of the decision of the control of the contr

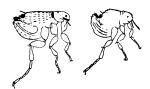


Fig. 7.—Pulex felis, the cat flea.

g. 8.—Sarcopsylla gallin-aces, the chicken fles.

facts has a certain interest at a time when the appearance of plague among rats in Suffolk has created a very distinct prejudies against the use of game, of hares, and even of imported rabbits as food. Every one would, of course, prefer not to cat any animal which could possibly have died from plague, but no one would be in the least likely to contract plague; by doing so. In view, however, of the fact which is now declared by the highest unthornly to be well established, that there have been covered two coses of plague pneumonia in Sufficient and the sufficient plague pneumonia in Sufficient and the sufficient plague preumonia in Sufficient and the sufficient plague preumonia in Sufficient and the sufficient plague preumonia in Sufficient plague plague preumonia in Sufficient plague pl

plague among rats in that neighborhood, it becomes important to inquire what the probabilities are of any considerable apread of the infection in England. "In any outbreak of plague in a new locality," anys Mr. Grown the factors which determine the extent and severily of the epidemic ers much more numerous than are greatly approach, and the margin between danger and safety is dependent on factors which are in themselves apparently, light. For occurring, it has already been

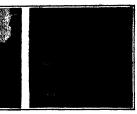


Fig. 1.-An old Bengalpura street. All the dwelling houses are above stables and there-fore, on the face of it, likely to be infested

Fig. 2.—The interior of a coolie's room Pote and boxes containing articles of daily dist are lying all over the place and affording shelter and facility to rats.

said that plague is spread entirely by plague fleas. This may naturally lead to the inquiry whether the last Great Plague of London, which proved so devastating, was spread by faces? If it were so would not this argue that the habits and dwellings of London in the late seventhern century were much more dirty than we have say the think that the habits and dwellings of London in the late seventhern century were much more dirty than we have say that the habits and dwellings of London in the late seventhern century were much more dirty than we have say that the habits and different the plague, apparently taking it from one another? That is certainly true; and the answer to these questions is to be sought in the fact that plague has more than one development. It may devolop into plague presumonis, which, of all forms of plague, is the most dangerous and the most infectious. The mortality in plague presumonis appearance of the most infectious of the most infectious of the most infectious that the contract of the present of the plague green, and is highly infectious to anyone on whom it may be discharged. Rata, also, may have plague pureumonis; and there is one instance at any rate in which a bacteriologist is believed to have contracted plague from the sputtom of a plague infected rat. The Great Plague of London took place in winters presuments hence the virulence and rapidity of the contagion.

"What then is the genesis and progress of an outbreak

and a large memory in the virulence and rapidity of the contagion.

"What then is the genesis and progress of an outbreak of plaque? Plaque, in the first instance, appears to arise in certain feel in Asia and Africa, where it always exists. In a locality such as Bombay, an outbreak among rath, and if a curve being the rise, culmination as the commitment of the plant of the plant

England the commonest rat is the so-called gray rat, Mose decuments, or Hanousrian rat, which usually inhebitis sowers, and is a ferce, strong animal, sky of human befligs. In India the commonest rat is the black rat, Mose rostes, which is not at all sky, and which, being showed we do so, lives on terms of intinney with the familiar budge, flut the black rat is found in England to the state of the state o



man. The second is the most common European vat fice, Coratopoglies fuscisties (see Fig. 10). But this fice will not feed on man, except when staving. The last and most important fice is Pulsa cheopie, the Indian vat fice, which, milks the European rat fire, readily feeds on a number of animals. In the absence of rats it will readily bless man.

Disney or Security to the state of the state



Fig. 3.—The house (at Parel) with the Fig. 4.—An at plant pot in front produced a very ed rats a large number of rats.







speed be of an entirely different order. At present negthers Surope, and to a less extent, Europe in the templettee such seems immune from an outbreak of plaque on seroust of the habits both of the gray rat and of the data which lives on 1:7.

Preserving Eggs With Water-glass

Preserving Eggs With Water-glass
TAGGS in large quantities are surcessfully kept in
Lood stones for many months, but this method cannot be employed by small dealers or housekeepers. Of the
moiseous chamical processes which have been devised,
only two, the water-glass and lime-water processes, have
been generally adopted. No satisfactory explanation of
the preservative action of water-glass (codium silicate)
has yet been given. The simplest theory in that the ports
of the agg shall are stopped by a precipitate of gelatinous silica and fast the revisited heavy in the first and
from hacteria. The collected solution cannot traverse
the smellers and that the revisited heavy general conglass and salcium carbonate hardens in the sir, although
no chamical reaction, causing the formation of calcium
silicate, takes place. B. Berger concludes from his experimenta, published recently in the Zeitz-shrift fast
Cheesis with Tackestrie der Keilolds, that the product which
a feeting the water-glass and the calcium carbonate
hardens in the sir, although no absorption occurs, and
stops the pores. Solutions of soop and other collicits
were found to exert a similar preservative effect on eggs.
The best result was obtained with a mixture of waterglass and a 10 per carbon collicits were found to the solution of the measure position of the water-glass was 190 to 195 deg. To

Lemparature of the search of the

Fog and Fog Signals

Fog and Fog Signals

UNDER the above title Professor Alexander McAdie
has written an interesting illustrated article which is
published as a supplement to the Worther Burner
Alexonological Chart of the North Pacific Coast* for
Alexonological Chart of the North Pacific Coast* for
Alexander Coast* for Coast*

and the air has a temperature of degrees.

The winter morning fogs of the same region—commonly known as tale fogs, because they form over the overflowed bottom lands of which the tale is the characteristic plant—are quite different, they more seaward, and are relatively shallow, so that it is nearly always possible by sending a lookout aloft to get above them and secure proper bearings. With the summer afternoon fogs this is impossible. For sometimes occurs at one time along the entire the state of the stat

18 impossible. Fog sometimes occurs at one time along the entire Pacific Coast of the United States. How far it extends seaward is not definitely known; the average distance is estimated at fifty miles, but in some instances it is sev-eral hundred miles.

eral hundred miles. Bealdes the ocean fogs and the tule fog, a nondescript smoke fog occasionally occurs at San Francisco, the fog moring seward during the forenoon and returning as a dense black pall shortly after noon. One of the forglest months to record was October, 1996, during which fog signals were in use at the light-nesses along the California coast from 200 to nearly 300 meanly 300 m

1993, during which for signals were in use at the augumouses along the California coast from 300 to nearly 300 hours.

Before the introduction of substantine signals, marine disasters due to the frequent insudibility of fog signals from aircus were of common occurrence in the harbon of the production of the Pacific Mail stranship "Rio de Janeiro," which was verected on the Fort Point Red during a fog on February 33, 1801. One hundred and twenty-serve lives were lost. The pilot was unable to hear the fog signals from either Point Bonita or Line Pelast on the north side of the harbon, or the toiling of the bell to the cast and north, though 4ft these signals were within easy hearing distance under normal conditions, and are rested intin. In other wonds, the sound saves were refracted upwards and passed over the rish. The repraction of sound owing to the presence of air strata of différent temperatures and dendities is a well-hours, phenomenon, but in the case of a well-defined fog bank reflection uppears also to play a part in assuing the respectable abservations of sound that are so pushing and danglesous to mariners. Professor Schuler described and passed ones the case of a well-defined for the production of sound that are so pushing and danglesous to mariners. Professor Schuler described and passed ones the respectable abservations of sound that are so pushing and danglesous to mariners. Professor Schuler described and passed ones the respectable abservations of sound that are so as a single stantant, which combine the markets to at titles simultanting and the position in a fog, when now a signal state.

The vessel, jetting equipped with viroless, sain the mea-inguist studies, size provided with viroless, to send office standinamonally by the two publishes at a time their large, and to remark the same at intervals of 10, size it states. These still be a motivate had been published to standard of the atherite shad the above water provided the satisfact of the standard shad the advocation of the standard of the standard shad the above water the standard of the standard shad the above water than the satisfact of the standard shad the standard provided the standard shadow the same standard to the same standard than the satisfact of the same standard than the same standard decisions and the same standard that the same standard than the same standard th

second, and through air about one-fifth as fast as through water. Thus at each signal the distance of the ship from its signal station can easily be calculated. Given the bearing and speed of the ship, and her distance from a known point on showe at successive moments, the instru-ment in question affords an easy means of laying off her course on a chart

Precautions to be Taken With Fuel Oil

Precautions to be Taken With Fuel Oil
TOR the benefit of those who use or contemplate the
Twe of fuel oil on board ship, the United States Nayy
Department has issued an order which we here republish
from the Hydrographie Bulletin. The instructions and
presautions read as follows:
"Fuel oil as supplied to vessels of the navy is the
residue of crude oil after the removal, by distillation,
of sulphur and volatile oils and gasses. It is inert,
non-explosive, very difficult to ignite in bulk, and not
capable of spontaneous combustion. The vapor from this
oil is, bowever, explosive when mixed with the sir, and,
bereits such as bilges and bottoms of tanks, where it may
remain undiscovered until ignited by a naked light or
spark. This vapor is always present in a partly filled
oil tank, or in a tank which has contained fuel oil and
from which the vapor has not been removed by artificial
means, and is given off through the vents from tanks in
process of being filled.
"A leak in any part of the oil-burning system may,
if allowed to endure, result in an accumulation of this
explosive vapor, unless the leak be located in the path of
air to the furnace.

The part of the contraction of the properties of green light, electric spark, emoking, apark caused by an open
light, electric spark, emoking, apark caused by artificial
means, sparks from funce, under boilers.

"An intelligent appreciation of the properties of fuel

An intelligent appreciation of the properties of fuel oil as described above is a better preventive of accident than adherence to any set of rules that may be pre-

than adherence to any set of rules that may be pre-scribed.
"The following detailed precautions will, however, be rigidly enforceds"
"I. When oil is being received on board, no naked light, amoking, or electrical apparatus lishe to spark will be permitted within 50 fect of the oil hose, task, compartment constaining the tank, or the vent from the

compartment containing the tank, or the vent from the tank.

"9. While receiving fuel oil the storage tank must be closely watched for leaks, and care must be taken that all outlets from the tanks except the vents are closed.

"S. No naked light, amoing, or electrical apparatus liable to spark shall be permitted at any time in a common term of the control of the c

in vent pipes from fuel-oil tanks are at all times intact, and smoking will be forbidded in the immediate vicinity of these vents.

"7. Dampers in the uptakes of hollers must be kept full open while burning oil. Otherwise there may result damperous accumulation of gas in the formace with a substantial control of the same than the same acting tanks shall be kept habitually shut. When a residing of the gage is desired the valves may be opened, but must be at once shut again.

"8. In each fireroom fitted for o'll burning there shall be fire extinguishing apparents, consisting of a "Steam fire hose, permanently coupled and of sufficient length to reach all parts of the fireroom, and either:

"(a) A box containing about two bandels of dry sand with a frage that the same and the same action of the same act

"15. For lighting the burners, a piece of burning waste on the end of an iron rod about four feet long is recommended. This is to protect the fireman from a back flash."

The "Hottest" Heat

NO feats of discovery present more points of fascinating interest than the attempts now being made by scientists to explore the extreme limits of temperature. scientists to explore the extreme limits of temperature. We live in a very narrow once in what may be called the great world of heat, a stretch of some 10,461 degrees, above to about 20 degrees below zero, i. e., we are able to withstand these extremes of temperature. If a world catastrophe should raise the temperatures of our summers, or lower that of our winters, by a few degrees, luman life would perish off the earth.

But though we live in such across white science has

catastrophe anomamens, or lower that of our winters, by a revenience, or lower that of our winters, by a meaning mens, or lower that of our winters, actence has found ways of exploring the great heights of heat above us, and of reaching the depths below us, with the result that many important and interesting discoveries have been made. The results of the experiments un exploring the depths of cold are interesting and useful, but in the opinion of a writer in the Tale Scientife, Monthly, are not of as much practical value as are the ex-

the depths of cold are interesting and useful, but in the opinion of a writer in the Yale Scientiffs Monkily, they are not of as much practical value as are the experiments with the bottest heats. Lest vibrations are inconceivably rapid. "Nearly all substances known to man become liquids and gass. If the experimentate of the plaids and gass. If the experimenter could go high enough, he could reach the high degree of heat of the burning am Itself, estimated at over 10,000 degrees. It is in the work of exploring these regions of great heat that such men as Moissun, Siemens, Faure and others have made such remarkable discoveries, reading temperatures on high as 7,000 degrees, twice the more wonderful when we consider that a temperature of this degree burns up or vaporiess every known substance. How, then, could these men have made a furnace in which to produce this heaft? Iron in such a best would burn like puper. It seems inconceivable that even science would be able to produce a degree of heat capable of consuming the tools and everything cles with which it produced.

The heat vibrations at 7,000 degrees are so intense "The heat vibrations at 7,000 degrees are so intense that platinum, the most refractory and most unmeiting of metals, melts like wax; the best fire brick is consumed like roots. It works, in short, the most marvelous and incredible transformations in the substances of the earth. The earth was created in a condition of great heat, and a dying volcano gires only a faint evidence of the heat which once prevailed over all the earth. It was in the time of great heat that diamonds, appliers and rubies were made.

"More wonderful, if, possible, than the miracles would be soon best but for other than no more were made.

water tumbles are every now sign, which the coal for the best modern blast-formaces, in which the coal for the best with a special artificial means to make it but in proceeding the second careety, the test may reach 5,000 degrees, and furnace. In porcelain killins, the potters, after hours of dring, have been able to produce a cumulative temperature of as much as 3,500 degrees; and this with the oxyhydrogen flame is the extreme of heat obtainable by any means except by the electrical furnace. Thus the electrical furnace has fully doubled the practical possibilities in the artificial production of heat under the process of the second production of heat with the second production of the se

The thermometer in use with the electrical furna-The thermometer in use with the electrical turnace consists of a locat thermometer registering any 3,000 degrees, which is set up some distance from the furnace. There can be no doubt that the possibilities of the electrical furnace are beyond all present conjecture. With American inventors buy in its future develop-ment, and with chaos electricity, there is no telline whet new and wonderful products may be manufactured."

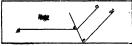


A Referendum

A Referendum
The Editor of Handy Manie Workshop is in a quandary.
At his survest collection, this department, which was
the survest collection, this department, which was
the survest collection, this department, which was
usery other week. But his collections are comprising
against him. They are trying to make him thick that it
department is far more interesting to him than to his
readers. It may be that this to ho and it it be not it is
hardly fair for Handy Man to occupy two calculate pages
of the Sunswinc Amenious energy two weeks. But is it
sof The Editor is not by ony means convinced. He lays
the question inforts his readers. Does Handy Manie
Workshop interest you? Do you find it of real practical
workshop interest you but to ware readwest differentially. Sti
your suggestions. Tell him what you want, heamen, after
all, the department is yours, and not hit. If you know
profited by the ideas of others, give others the baseft of
workshop kinks, and page promptly for such as are
accelebles. Address Handy Man, Schumpire American,
New York.

Miter Box for Odd Angles By W. D. Graves

WHILE a miler joint seems to be the only practicable one for many jobs, it is one of the weakest and most unstable jointures used in wood work. Wood is an unstable material, swelling or shrinking with every change of molature conditions to which it is exposed, and no two pieces act just all'e. For this reason pieces of it should be so joined in their change in size may off it should be so joined in their change in size may be allowed the considerable of the control of the property of the control of the property of the control of joining unless the material is thoroughly dry and will be well protected from changes of moisture conditions. Even



Layout for an obtuse

Layout for an obtuse-angied miter joint.

then its only escuse is its looks, but as the only reason for most moldings is grammentation, and as the miter is the control of the property of the control of

where the same where to be there in the lost, leng stire warfully to these marks.

The stress laid upon the necessity for working from the inadds is not intended to imply that the outside about less left rough; but, however nicely that is finished, dependence for accuracy should be solely upon the inadá, for divided responsibility in mechanics, as in everything cise, tends to trouble.

Though a miter, as the unqualified term is used among mechanics, is usually understood as the bisection of a right angle, it is not necessarily so; for pieces may be mitered at any angle. To set a bevel at the proper angle for a square miter, i. e., 60 degrees, place the stock unglant one side of a steel gazars, and swing the blade till its edge_machty coincides with corresponding graduations on the two blades thereof; Bast is, so that it shall be exactly the same distance from the corner on each side.

Of course, we sell know how to bissect an angle grower-rically, by the use of the divideor, but as it is handler he set a bovel by the edge of a board, and as it is superior what difficult is handle divideor, but as it is handler he was the course of the

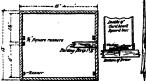
Case for Phonograph Records By Ralph C. Davison

By Raign U. Javasson

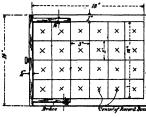
A.I.J. those Who own a phonograph know how fast the
Amcords accumulate and how necessary it is to provide
a proper place for their safe keeping in order to avoid
their being knocked over and becoming cracked or
broken. The regular cases one can buy for the above purpose are expensive, but a cheep and useful one can be



Sectional view, showing location of ru-



nt view of case with drawers res





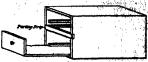
Pan and side views of the re

ands at home by any one who is handy with tools by falleving the directions as given below.

Any kind of wood can be used. The writer made a
very effective case of bales whatt, saing giaza knobs as
very effective case of the writer was a contion base to the saint of the saint of the saint
too has two drawers. As we case shown in the illustration has two drawers.

The saint thing to do is to make a how, the finding
dimensions of which must correspond to the size of five
use. The bott eightid be made of at least 4,488% has in
trial, and shaped be provided as shown with the dedied it
use. The bott eightid be made of at least 4,488% has only
of the drawers in the case shown as 12 to be and howform runners far the drawers to falle horizon. This provides come for 24 records. This provides come for 24 records. This provides come for 24 records. This provides come for 24 records.

which to place the results there is which they are by their better and markly better and markly, the requests from Since it which they are braught into cond-ing the condition before plants that the conting the receiving from the page they are created by one for finger into the con-tinuous there is no due of injury from its boses there is no due of injury from its offer of the concentration of the con-tinuous three is not been as the con-tinuous three in the con-tinuous three in the con-tinuous three into the con-tinuous three with one are inside below aboves. Then with one are inside below



The empty case with upper di

The empty case with upper dinawar removed, contess thas marked, large enough to receive the points a hole through the capter of the bottom to point a hole through the capter of the bottom of each bee, large enough for the acrews to pass through caisly. Now drop a washer down into the bottom of the bor and center it over the hole. Owing to the snall upsenges is the house one will find it hard to get the screws into the heles without using some special device.

The simplest way to get these screws into piace, I found, was to take a thin piace of wood and to split if at one end, as shown in the illustration. By placing the head of the screw in this slot, as shown, they were held tight content to allow of passing then through the hole in the hole already made to receive them in the horton of the drawer. The wood bolder was then released from the screw and it was driven home with a loin general from the screw and a most convenient and safe piace in which to know a man and calendar, were pasted on the top of each of the record boars. These numbers of the records were discarded, and in their stead good sized numbers, cut frest an old calendar, were pasted on the top of each of the record boars. These numbers were placed in regular order, the first drawer containing samplers from 1 to 85 are not as the same of the record, with their new numbers product, the first drawer containing samplers from 1 to 85 and the names of the record, with their new numbers product the names of the record, with their new numbers product one wishes to play.

The material list for making the above case is as follows:



The Handy Man's Furnace Ashpan By C. F. A. Siedhof

By C. F. A. Sisshed

TO the man who takes ear of his own furnace (and

It to his wife perhaps more so) the removal of the
askes with the accompanying dist, is a decided hughest,
As a result the sah removal is done as infrequently as
possible, thereby endangering the grate, by allowing the
sahes to accumulate in the ast-pit. If this same mean
will make, or have made, a pan to fit the sab-pit of his
furnace, he will be surprised that he never had one herion.
I have had one made and in use for some time, and have
nuch time in hastiling the sabos.
The pan was made a close, but I you means a tight
sit, shabling it to be ossily removed. The pan should be
rounded at the laner sent to confirm to the shape of the
sab-pit. If the pit within the sah door is circular, as is

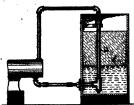


is a view to handle had either. The statch shows upon design, for such a turners sub-pan, which appear, he maddled to meet individual noces. It is have the more and under with considerable individual, in order that it may fit as closely the against the back wall of the nab-pit.

Has Passaling Connection Jacket

By Jacob F. Kropp

By Jacob F. Kropp or J. By Jacob F. Kropp or J. By Samurapaying capraving illustrates a method of B consensing up the tast of water-cooled engine, so that freedom on the first of water-cooled engine, so that freedom on the first of the cooled on a bracket. The upper end of this production. Within the water task a vertical tension of the cooled on the first of the cooled on a bracket. The upper end of this product has the lower end, the pipe is connected by a T-string to a cross-piece which passes through the side of the task. Close to the T-string a 4,-inch hole is drilled through the pipe. The projecting end of the cross-piece in connected by meany of a rubber hose to the laide end of the water jacket of the engine, while from the outlet a pipe is extended to a position directly above the funnel mouth of the pipe in the tank. In practice, when the task freezes, were though the ice forms solidly to within a few landes of the bottom, there would be no interrup-



ction for the wa

tion of the circulation, because the water is taken through the \$4, eith hole. When disconnecting the tank, the flanged based of the vertical pipe is used as a bandle to screw the pipe fint the T-connection at the bottom, until the \$4, inch hole is covered. Thereafter the rubber hose is removed, permitting the verter in the vertical pipe to drain out. When starting the engine, it is merely neces-trated to the starting that the starting the engine, it is merely neces-trated by the starting that the starting the starting the purpose one water into the vertical pipe, after which the pipe may be turned to uncover the \$4-inch hole. n of the circulation, because the water is taken throu

Remairing the Bottom Wall of a Lead Pipe By Albert F. Bishop

By Albert F. Blakep

I N case of a leak in the bottom wall of a horisontal
lead pipe it is often better to repair than to renew
the pipe. Cut a slit in the upper side with a thin knife
and work the pipe open so that you can acrape the pipe
bright and do your soldering on the inside. Use realn
with the solder when soldering lead with a soldering
copper. When the leak is scaled over with solder work
back the lead on the upper wall, closing up the hole you



made with the knife and solder it. This wrinkle not demand an expert workinso. Indeed, it is still, whether an expert could solder underneath the astisfactorily anyway.

Automatic Cut-off for Electric Gas-lighting Circuit By E. W. Williamson, Jr.

By R. W. Williassons, ir.

It is probable their everyone whose dwelling is fitted with silectric giz lighting, her form annoyed at one time or sinther, by the presenture exhaustion of the attacks, through an accidental ground or short circuit, is to define of the wires or to abuse of the bursers or the treatment of the wires or to abuse of the bursers of the wires or to abuse of the bursers of given the account of the wires or to abuse of the bursers of the present of the present of the second of the constitution of a ground or short directly significant or the substant dwell. It was necessary with the complete up of the spring middle date in the first the constitution of the spring middle of the constitution of the constitution

greph. The J. theory, store the experience is not the drawing. The S. the details and in the of one and on this res. A ben hard in against in S. attle most detailed, and at 1800 man and the weeden aprights. S

inches long. To these were screwed 1-inch strips of thin brass, 14-inch wide, the ends projecting 14, inch above the wood, and a 1/38-inch hole was drilled in each projecting end to form bearings for the spindic. This was a 3-inch hongit of 1/41-inch round brass rod, each end bring drilled centrally to receive a piece of this wire mail, to fit loosely in the bearings and reduce friction. A grooved pulley, 31/4 inches in diameter and 14, of an



Automatic out-off for electric gas-lighting cir

inch thick, was turned from soft wood, as was a spool 3 inches long and ½, inch in diameter, with a ½-inch fining and ½, inch inch and ange being ½ inch wide, and in canned out with neither with a ½-inch hole, and reamed out with neither with a ½-inch hole, and reamed out with neither with a ½-inch hole, and reamed out with neither with a ½-inch bord, and reamed out with neither sole, so as to revolve loosely on the spinofit.

A clutch was now fitted to the face of the pulley, consisting of two arms of \$/16-inch square brass rod, 9 inches long.

At one end was soldered a ½-inch brass ball, and the other end, was filed out in a curve to correspond with the circumference of the broad finings of the spool. The arms were then drilled through at a point ½ of an inch from the lower end, and accessed to the pulley face, with a washer benesst, and loose enough to swing freity, plins being driven into the wood at each side to limit the movement. A light rubber band was stretched from each arm to the pin, to pull them sway

was stretched from each arm to the pin, to pull them away from the spool when at rest. The spool was then slipped on the spindle, the pulley driven on with a tight fit, and the whole mounted in the

be wince motors.

A dollar electric motor, with a three-pole armature, was now screwed to the base about 4 inches back of the pulley, and belted to the latter with a loop of shoe thread, waxed.

panely, and decise to the secretaria a noply of secretarial ways and the secretarial ways are secretarial ways as the secretarial ways and the secretarial ways are secretarially in the wooden uprights, a 4-inch wooden strip, 1½ inch wide, was nailed to the base, pointing downward, and on this was pivoted a contact arm, with a wire ring at the outer end, through which the weighted thread was passed. As the motor would not run on the regular battery circuit, when in series with the parks coil, the force over the state was restead with the secretarial ways and the secretarial ways and the secretarial ways are secretarially as the secretarial ways and the secretarial ways are secretarially as the other a hit of platform foll. On the coil head was fixed a short place of platform wire, and the contact of these closed a local dresult of two cells, to run the motor. Rather delicate adjustment was required with these con-Rather delicate adjustment was required with these con-

these closed a local circuit of two cells, to run the motor. Rather delicate adjustment was required with these contacts.

The connections were made thus: The lever switch on the lower strip was cut in, in series, between the spark coil and the battery.

The spring contact on the end of the cull was put in series between the local cells and the motor. The operation is as follows: When a pull burner is operated, the one of the coll will strive the same transport of the contact of the coll will strive the same transport of the contact of the coll will strive the same to the contact of the coll will strive the same transport of the circuit and bolds it so the motor species up. causing the arms of the clutch, A greand, however, closes the local circuit and bolds it so the motor species up. causing the arms of the clutch to close on the spool by centrifugal force. The latter then terms with the pulley and winds up the cord and weight, the latter finally tripping the rain circuit. The cut-off should be set at sufficient elevation to allow of a drop of three feet for the weight, and will then open the switch in five seconds. A good way is to suspend it from the joilst of the cellar, as the cell and shuttries are often hung thus. The dimensions given are not necessarily to be followed, but may be varied to suit the convenience of the constructor. The operation of an automatic does not eart the machine at all, owing to the rapidly broken contacts.

Rawhide Hamm By H. M. Nichols

THE accompanying sketch shows the details of a newhole hadden that will be found very useful around

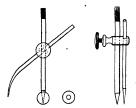


a shop for driving arbors in place, and for numerous other jobs, where it is essential that the work be driven tightly in place without being battered or marred. This hammer can be made in any size, depending on the class of work it is intended to be used for. First

use cases of wors a is memoral to be used 107. First get a piece of steam plps A of the proper diameter, and drive the rawhide B into it, allowing it to stick up from a balf to three-quarters of an inch above the plps. Their drill a hole through the center of the pipe and rawhide, and file it to fit the handle in, fasten it in place with a small iron wedge, C.

Cone Center Dividers

THE accompanying drawings show a handy pair of dividers, which will be found useful for scribing accurate lines around existing holes or centers. This



tool consists of the clamping sleeve and needle of a regular surface gage, and a hardened centre box having a 60-degree cone center at the lower end. The center bar is made of drill roal just the size of the surface gage bar, so that the sleeve will fit on. When the holes to be used as centers are larger, a 5/16-inch

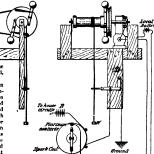


Fig. 2.—Construction and wiring diagram of the cut-off.

ball is used. The ball has a 60-degree center made in one side as shown. The ball is magnetized, so that when placed in postnon it will not fall off. This tool has been found extremely handy for all-around work.

How to Caliper Over a Flange

A HANDY little kink is pictured in the line cut, showing how to caliper over a flange when there are no blocks available for building out far enough for the calipers to clear the flangers. With a small prick punch make a mark in each leg of the caliper, and when



Calipering over a flange.

the estipers have been set over the flange to get the size of the rib, as shown in the sketch, a "air of dividers are set carefully" the punch marks. The caliprers are then removed over the flanges and reset, using the dividers again, when the size of the rib may be determined by scaling the calipers.

A Novel Compass for Aeroplanes

The Needle Points Out the Direction of Travel

The A Tompass which has just been inverted by Mr. A C. Marquis, of Richester, N. Y. This compass differs from all those of the ordinary type in that the needle appears to more and point to the last sever great advantage for inceptrienced aviators, for instead of having to fix the compass needle and the chart, they can tell at a glance which way their machines are headed. The compass consists of a needle mounted in the regulation way so that it can swing and direct itself to the North. Surrounding the compass needle in the same borisontal plane is the chart taving the points of the compass nearly in the compass needle in the same borisontal plane is the chart taving the points of the compass nearly of the compass needle in the same borisontal plane is the chart taving the points of the compass nearly of the compass needle in the same borisontal plane is the chart taving the points of the compass nearly of the compass needle will be chart to the compass of the compass

curately the course being followed at every moment. On the rear of the instrument there is a place arranged for a lamp, the rays of light from which are refected upward through the dial and thrown upon the nature of the case it is desired to use the instrument at night. The rear of one of the smaller experimental models is illustrated as well as the front view of the large

An experimental Marquis compass with the needle in alcuhol to deaden the vibrations was recently tried by

Two models of Marquis's compass, showing rear and front respectively.

William Hilliard, the aviator, at Bilancia. La dis-results obtained were satisfactory with the majorition a heavier fluid than alcohal was found to be regulated order to deaden properly the vibrations of the majority over to use on property me vicrotices of the statelle. It was found necessary to please the instrument more tight feet in advance of the engine in order that the majneto should not affect it. There have been a number of novel compasses devised of late for avistors, but the one herewith illustrated seems by far the most practical and intentions of them. 21

mpasses devised of late for avisions, but the one servith illustrated seems by far the most practical and gallons of them all.

An interesting fact in connection with the Bouth-pointing needle was unservided by the Bouth-pointing needle was unservided by the Bouth-pointing needle was unservided by the Bouth-pointing needle was placed in an extract from the writings of Humboldt. It referred to the use of a South-pointing coist-pass by the Chinese in the year 9800 B. C.—a use not for water, but for land navigation. In the forward part of a wagon or charlot there was placed a freely floating leddentone which moved the arm and hand of a small figure and Kipproth, whose reveatches upon this subject have been confirmed by Blot, Stanllius, and Julias, found an old tradition from which he believes that this magnetic wagon was in use in the reign of the Emperor Homagit, who is believed to have lived at about \$800 B. C. Magnetic wagons were, however, used as late as the fifteenth centure, and several of these were preserved in the Chinese Imperial Palace and were several in the Chinese Imperial Palace and were several in the Chinese Imperial Palace and were several in the Chinese Imperial Palace and were fifteenth contury, and several of these were prieserved in the Chinese Imperial Palace and were employed in the building of Buddhist monasteries for fating the points towards which the main sides of the building were directed. The inventor of this new acronautical compass has apparently, therefore, hit upon the oldest form of compass, and by improving and bringing it up to mouzern requirements, he has changed it from a compass for directing land courses to one for indicating the path of air craft.

Ruhmer's Recent Work in Wireless Telegraphy

Some New Methods of Transmitting Speech Without Wires

By Dr. Alfred Gradenwitz

SHORTLY after Marcoul's first experiments in whreshes telegraphy, a system of whreless telegraphy, a system of whreless telephony based on similar principles was suggested by several experimenters. The actial of the transmitting station was to give out electrical waves corresponding to the sunod vibratiums, and tiese were to be absorbed by the receiving artial in order to be reconverted into sound waves. While the control of the converse of the control of the receiving artial in order to be reconverted into sound waves. While monitable difficulty, nearly ter years were required to perfect a suitable transmitter, a very sound vibration, directly, the fluctuations in current intensity produced by speaking against the membrane of a microphone for excling the aerial of the transmitting station. On account, however, of the low frequency of sound vibrations, this method had to be discarded from the very beginning, it being suggested to transform the microphone currents to a high tension utilized in feeding a spark-gap which in its turn would generate the rapid relations, required for exciting the antenna. This scheme cell results either, as the

cal results either, as the upper barmonics, characteristic of vowels and consonants, were found not to set up any spark discharges. Moreover, the amount of energy converted into electromagnetic waves by meas of ordinary microphones did not allow of any were less communication to a considerable distance.

tess communication to a considerable distance of the statement of the stat

aim a few years ago was at-tained in wireless teleg-graphy by two different methods.

nethods.

In connection with one of these methods, based upon Tesla's experiments, vibrations are generated by a high-frequency alternate current dynamo. The most

successful experiments in this direction have been made in America by Feasenden with a machine operated by a steam turbine, which with 16,000 revolutions per minute produced about one kilowatt alternate current of 100,000

produced about one kilowatt alternate current of 190,000 cycles per sector.

The produced about one kilowatt alternate current of 190,000 cycles per sector.

The capacity and self-iduation be connected up in parallel to a direct-current are passing between homogeneous carbons, this, under certain conditions, gives out a sound corresponding to the characteristic electrical withertoon of the whratory circust. This sound is only a secondary phenomenon attending the production of alternating current in the vibratory circuits. While the energy thus converted into vibrations, and especially their frequency, are too low for the purpose at issue, both factors are increased considerably by placing the are in a natmosphere of high best conductivity, such as hydrogen or lighting gas, as first suggested by Poulsen.

A "singing are" improved in this manner really allows alternate currents to be generated with an energy and

Relay for operating calling helt.



Old type of generator.



The latest reperator.

Detector med by Rehman

RUHMER'S RECENT WORK IN WIRELESS TELEGRAPHY

frequency sufficing for the purposes of wireless telegraphy and telephony. It will be resultly understood that the designation "singing acc" in the human car being incorpable of perceiving the accusate reflects of an act reversed by several hundred thousands of wibrations per second. The detector used in connection with this system of wireless telephony is a minute thermo-element consisting of two conductors as widely separated as possible in the series of thermo-electric transions, which on the passage of very feelbe divinctions generates an undusting direct over the properties of the properties of a sensitive galvanumeter a telephone of the properties of a sensitive galvanumeter.

of very feeble vibrations generates an undulating direct current perceived by means of a sensitive galvanometer or telephone. As regards, next, the application of the above principle to the purposes of wireless telephony, the vibrations to the purposes of wireless telephony, the vibrations to the purpose of wireless telephony, the vibrations to the purpose of which the current perceived out in actual practice.

Ernst Ruhmer, of Berlin, the well-known experiments and physicist, some years ago cummenced some experiments in connection with which the current feeding the generator of the "aingtone of the proposed of the



The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting



Picking Cotton by Machine By William Day

Picking Cotton by Machine

By William Day

TOHE greated obtacle in the development E of Southern agriculture has been the necessity of tulingh hand labor in gathering the cotton crep. A large portion of the nagro population, men, women and children, are unployed the nagro population of the nagros frequently place unripe boils which must be thrown away as useless.

Remomehring that the Southern cotton Remomehring that the Southern cotton for the nagros and the nagros frequently place unripe boils which must be thrown away as useless.

Remomehring that the Southern cotton for the nagros and the nagros of the nagros o work is so small as to be insignificant, as compared with the great waste which re-sults from careless picking by the negroes. The mactine picks about 10 pounds of seed cotton per minute, or 6,000 pounds per day of 10 hours, ff kept ruaning continuously, or 5,400 pounds per day, allowing 10 per cent for stoppage. The quantity picked varies somewhat, depending on the amount of ripe cotton on the plants, but the above amount may be considered as a fair average. On the first tird it suthers 80 per cent of the

solutions the plants, but the above amount more considered the severage. On the action of the considered there 80 per cent of the ripe cotton, and the remaining 10 per cent is picked on the second trip.

An average of thirty heres-power is required to operate this interesting cotton picker. A gasoline motor of 30 horse-power is usually installed for the service. Beneath the engine are what are trende two picking attachments swung under it, and a pair of canrae begs hung out behind. It moves over the field as fast as a mon walk, the wheels passing lang the spaces between the rows of plants. The cotton is picked over? by the revolving sized function that the second is the second plants of the second plants. The cotton is picked over? We have been plants that the second plants are the second plants of the second plants

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The latest type of cotton wicker, with caring opened to show the mechanism



The modern cotton picker in operation.



eves between rows, so that the pickers play upon the belis

THE NEW COTTON PICKING MACHINE

contents The drum is moving buckward at the same rate that the whole muchine did not move herizontally through the plant, but merely turn in it. In the cylinders of each picker are no less than \$16 of the steel fluggers which harvest the cutton. But one man is required to operate the engine, while he also steers the mechanism. A boy may be employed to all in the rear to be more than the steel of the steel cept for a few green leaves, the cotton is as clean as, if not cleaner than, that hand picked.

This remarkable invention may be called

nicked.

This remarkable invention may be called the life work of Angus Campbell, a Scotch linevitor, who for many years has lived in Texas and has made a study of plans to economise the gathering of cottin by partiable mischinery. Mr. Campbell has worked on his plans of the plans to the plans of the plans of the plans to the plans of the plans of the plans of the plans of the present model, some defect has been found in operation which prevented the cotton placer from being of practical sus. Knowly of the latest type, however, are now in operation to show bevond question that the present model is remarkably efficient and that it has many advantages over the old hand picking method not only in reducing the theorem of the plans of the pl

cotton fiber has been broken or otherwise injured by being pulled out by the needles instead of fingers. Examinations have been made of cloth in the various stages of manufacture at the Wamautta as well as several other mills. A bate of hand pucked and a babe of machine picked were passed through this textile plant and the conditions were fully studied. When the cotton reached the mill it was devioud in the exreached the mill it was decided by the experts that the machine pixels color was slightly higher in grade than the hand picked color. The custom in both cases was then passed through from the raw state to the sower cloth. In the picking, carding and other departments, the percentage of waste was the same to a fraction, frequently. In the spinning there was no greater bendance in the marchine was no greater bendance in the marchine picked were operated, the vollers set and the total was the same in both instances. The breaking strength of the yarn showed a fraction stronger, one or two pounds stronger. In the machine picked stapic. The fiber used was 1-inch to 11/45-inch cotton again in twenties. It broke at a pull of the property of the stapic country of the stronger of the strong

The Pan-American Union and the Inventor

Inventor

John Barrier the Director-General

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sharing an parameter between these hardeness are the catenation of commerce between these nations.

Accordingly this preliminary conference was called, and in order that its official character should not be open to the alightest doubt, Mr. Barrett invited the President of the United States to make the address at the opening session, to sound a note of welcome and co-operation. An innovation which succeeded in pleasing everyone was the determination, which was right-by carried out, that in place of a long long that the content of the content

the theory succeeding days of the conference, a long list of speakers took part. On Friday, the Commissioner of Patents, Mr Edward B Moore, was to have addressed the conference briefly on the purpose and scope of the three conventions regarding trade-marks, putents and copyening trade-marks putents and copyening trade-marks putents and copyening trade-marks putents and copyening trade-marks putents.

was III and was unable to speak on this vers important subject. This Paus-American Commercial Conference being wholly preliminary, there was no thought of formulating by its means any definite plans with regard to the acceleration of trade-relations or exchange of commerce, as it was termed. The purpose was to get as far as possible the attitude of each nation, through 1th duty credited representative; and while the matter was not the monthly attached to the control of the commerce of the control of the control of the commerce of the control of the co each nation, through its duly credited representative; and while the matter was not it
thoroughly shausted, a good general idea in
has been gained as to the poultion of each
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one it is expected the Pan-American has
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upon the subject of interchange of comnarce—a subject which is so with to the
life of each country as a nation.

The aid given by the United States hy
at the promulgation of the three Buenos is
Alres conventions is faily acknowledged.
The manufacturer and the inventor in each i
subscribing nation can rest assured that in
exporting his goods into the other subcarbibing countries he will be to lopage;
forced to compete with infringing criticies, e
Trade-marks will be respected; patents is
will be upheld, and copyrights will carry (

the same value in foreign gatiens that they do in their own. It is particularly as account of these matters that the type of American commerce are turned upon Mr. Barrett's Commercial Conference. When the report is published, there will be no doubt a wide demand for it from the leading commercial houses of the countries. That the merchants and manufacturers took a large interest in the proceedings is a large interest in the proceedings is smitatives from all over the United States. Boards of Trade, Cambres of Commerce, Bankers' Associations, Manufacturers' Asso

A Convention on Copyrights

is then.

A Convention on Copyrights
A COPY of a convention concerning litter
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August 11th, 19th, by the delegates of the
United States and of the other countries
represented at the Fourth International
Congress of American States, has been sent
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and protect the rights of literary and artistic proporty in conformily with the stiplations of the present convention.

Second. In the expression "filterary and artistic proporty in conformily with the stiplations of the present convention.

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therein; consequently said throught by such author or his representability said throught by such author or his representability saids such creature or visiators, shall be admitted by the courts of the signatory dates.

Sixth. The authors or their sastigas, ettissen or desatled foreigness, shall exity or the signatory countries the rights that the respective have accorded which these rights competed to the same accorded which the rights that the respective has a complete some them to respect to such For works comprising several volumes that are not published simultaneously, as well as for builtens, or pertodical publications, the term of the copyright will commence to run, with respect to each volume, builtens, part or periodical publication. Beruth. The country of origin of a work will be deemed that of its first publication in America, and if it shall have appeared simultaneously in several of the signatory countries, that which face the shortest period of protections. In the same manner as original works.

Nitth Authorized translations shall be protected in the same manner as original works.

protected in the same manner as original works. Translators of works concerning which no right of guaranteed property exists, or the guaranteed copyright of which may have been extinguished, may obtain for their translations the rights of property set furth in article 3, but they shall not present the publication of other translations of the

in article 3, but they shall not prevent the publication of other translations of the same work.

Tenth. Addresses or discourses delivered or read before deliberative assemblies, courts of justice, or at public meetings, may be course of justice, or at public meetings, may be consisted as a proper of the property of any authorization, with the constitution of the demand, however, to the provisions of the domestic legislation of each nation.

Eleventh Literary, scientife, or artistic writings, whatever may be their subjects, published in newspapers on magasines, in any one of the countries of the Unique, shall not be reproduced in the other countries without the consent of the authors. With out the consent of the authors. With outcomes of the countries without the consent of the authors. With outcomes of the countries of the property prohibited, but in every case the source from which it is taken most be expressed by prohibited, but in every case the source from which it is taken most be expressed by prohibited the countries. The property of the property of the property of the purpose of instruction or chrestomathy, does not confer any right of property, and may therefore to freed made in all the signatory countries.

does not confer any right of property, and may therefore be freely made in all the signatory countries. The indirect appropriation of unauthorized parts of a literary or artistic deemed an illust reproduction, in so far as it effects civil liability. The reproduction in may form of an entire work, or of the greater part thereof, accompanied by notes or commentaries under the pretext of literary criticism or amplification, or supplement to the original work, shall also be considered illicit. Fourteenth. Every publication infringing a copyright may be condicated in the signatury countries in which the original work had the right to be legally protected, without prejudice to the inferenties or penalities which the counterfelieve may be continued in the signature which the counterfelieve may be competited.

rending the Commissions of all these life Tables of the Commissions of the Commission of the Co nemen the Communication in which he remains Court, and Mr. Josef Commissioner's foldings to be five cases in which he destributed.

Notes for Lavard

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Patents and Trusts.—Many times the value of a patent is established by the strength of the products. -sah attorney tells of a patent, now expiged, foca. sample article. It was limited, necessarily so, because of what had been done, "petero. Some years after the lessue of the patent, ple arthle. It was limited, necessayity so, because of what had been done, before. Some years after the issue of the patent, a large concern, some would call it a trust, realising that a market could be created for the article and an outlet afforded at the same time for a wate preduct, secured the rights under the patent duct, secured the rights under the patent hand, a large state of the real patent was done to the patent was not market, it was able to put up a strong fight. When last seen, the patente told of the patent was not material, as it was able to put up a strong fight. When last seen, the patente told of the patent was not material, as it was able to put up a strong fight. When last seen, the patentes told of the patent was not metrical, as it was able to put a strong fight. When last seen, the patentes told of the patent was not metrical with the patent was able to move of li now than even." In the meantime he had developed a fine plant with a waste product of his own, was able to make the reapple the patent. And is now reapple the patent with a waste to product of his own, was able to make the reapple to the patent.

Another under the preceding influsions of the patent.

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Another under the protecting influence of the patent.

Another Seldem Patent.—George B. Selden, whose patent, No. 369,169, has been the subject of much important litigation in connection with the automobile industry, was appellaint in a case decided by the United States Court of Appeals for the District of Columbia early in Petruary. The subject was an application along the patent of the patent in the Court of Appeals of the Appeals in the 18th 1878, the parent application side May shi, 1878, he parent application of May 9th, 1879, having matured into patent dark in the calculation of the Selden patent. The division was required by the Patent Office, and denigate the procession of the divisions of the patent of the Court of Appeals in Administration and the control of Patent Office, and division of the Court of Appeals in Administration, and division for the Court of Appeals in Administration, and division for the Court of Appeals in Administration of Patents, beld that the application study of Patents, beld that the application study of the court of Patents and division for the court of Patents of the court of the

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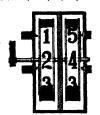
WAT FIFE FASTANCE.—RORMET L. RATNOS.

Estimater, Pr. The invention to plettered in a comparing between than it as new form of tensors or spring cleap disapted for attachment to this ecourn of a hat and to receive and it a but pins to that it forms practically a remanent attachment of a hat. Means probe that the side of the hat is not placed that the side of the hat is not placed.



and injured or worn out by continued piercing of the pin as when no clasp is unphysed. The size of the opaning in the clasp relative to the pin allows the latter considerable freedom of educatement so that the pin may hang at the angle to the hat crown, which avoids leverage and strain on the latter.

Effectives Devices,
TMDICATION DEVICE—CLARY N. WINNER,
Manples, Tunn. The Invention relates to devices for nas be indicating stock quotation.
As object in the improvement abown beswrittle
to terroride devire which may be manipuinted by an operator at a central station so
as to display visitle signs for indicating values
and locations, thereby dispessing with the



ENDICATING DEVICE

necessity of the customary ticker now used in most brokers' offices. A plurality of three devices may be run from one lay set made by connecting certain magnets having similar potential contenting contenting contents. The set of the content conte

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integral with the shoes. It further relates to special provision for holding, within the moid, the metallic back or other member to be thus united with, and merged into the casting.

The state of the s

united with, and merged into the casting. NON-REPTILLHAIL HOTTER— WILLIAM H. BOTLLAM H. BRELLOW and SAMUK. BURNE, Haidedon, N. J. The object of the invention pletured in J. the eagraving. Is to provide a convenient, strong, and durable non-reillable bottle inexpensive to manufacture, which permits field to be freely poured from the bottles but renders the intro-poured from the bottles but renders the intro-



duction of fluid through the nack extremely difficult, which cannot be filled by inverting the bottle in a body of fluid, as the valve member will float into a closed position, and which is so constructed that the valve will tend to close even when the neck of the bottle is arranged to a barbonation or slightly downwardly inclined in a harbonation or slightly downwardly inclined

position.

STEINIG.—J. II. Summa. New York, N. Y.
This invention relates to syringes of the barrel and piton type, such as in Letters Pietes of the U. S., formerly granted to Mr. Sherks. The sim of the present invention is to provide a syrings composed of comparatively few parts, composed of comparatively few parts, course in the comparatively for parts, and the provide of the comparatively few parts, course in the comparatively few parts, or provide a present in the provide present of funds. Despetit of the comparative provides present in holder of a type adapted to set, if desired, as a paper herwith is to provide a pre and pendi holder which can be extended up into a convenient



projecting position, when in use, and folded down into a small compass, when not in use. A very simple and efficient device is provided, whereby pens or pencils may be supported in a readily accessible position, even though the devices is located on a book or a desk piled

WILL PAPERS.

MAIL POUCH THANSPERRING APPARATUS.—RAI S. SCOPIELS, Clarkston, Wash
The invention illustrated herewith provides a



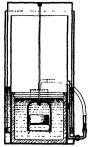
secured. The hook, which is provided for engaging the ring, has a spring for preventing the secape of the ring after it has been caught. The hook is secured to a pivoted rod, yielding means being provided for holding the rod extended and against rotation.

tended and against rotation.

HOBESTIOD AND CALK THEMEPOR.—J.

W. MILLER, Red Wing, Minn. The purpose here
is to provide cestles for the heese and teo of a
horseshoe, having novel form; and further to
provide means for attaching the calks to the
shoe in a manner that will permit the calks
reproduced by others that are, now or have heer
repaired, so as to be capable of renewed
service.

OXYGEN GENERATOR.—RICHARD C BRAD-LEY, Shreveport, La The invention in this in-stance is illustrated by the accompanying on-graving, and its object is to provide a portable gonerator which will automatically generate ass as fast as it is consumed, and in propor



OXYGEN GENERATOR

tion to consumption of the gas. A further object is to provide a device which can be used as a cartridge for generating the gas or with an auxiliary dovice for generating the gas by means of hest. The generation of gas is automatically regulated by merely turning the stop cock off or on.

Machines and Mechanical Devices.

Machines and Mechanical Berices.

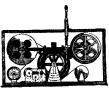
REMARKING MECHANISM POR BOATS.

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REGISTER FOR WEIGHING SCALES.

for the register with the sale beam, feelble in character, to accommodate the irregular move-ments of the beam Between the loading of each individual car, if desired, the markinery of the registery may be changed so that the successive cars are registered from an initial

successive cars are registered from an initial loading point.

CAB FENDER.—J P. GRAGHET, Jersey City, N. J The object of the present inven-tion is the provision of a new and improved car fender, arranged to insure the safe picking up of a person or other obstruction in the path of the index and without danger of mainting or otherwise injuring the person or other ob-traction.

Norm.—Copies of any of these patents will be furnished by the Scunrippe American for ten cents each. Please state the name of the patentee, title f the invention, and date of this paper.

NEW BOOKS, ETC.

AMERICAN MEN OF SCIENCE A Biographi-cal Directory. Edited by J. McKeen Cattell, New York The Science Press, 1910.

Cattell, New York The Science Press, 1900.

The last decoule witurescel a remarkable from the property of the

Simpley, find some on carea quarte approximately and therefore, when a faith though a matter of comment among the selectific workers themselves, seems to be but little known to the great to public, which is against the control of the proximate of the proximate of the great to public, which is against a second control of the control of

ment of Agriculture is likewise entirely un-justified. The real reason why the Department is is losing some of its best some is due to the increased demand for investigators in our uni-vertities, and to the fact that the college presi-dents have feared that such men are available in some of the burnaus is in weshington.

DAN SYSTEM DER BIOLOGIE IN FORSCHUNG UND LEHRE. By Dr. Phil. S. Tschulok. Verlag von Gustav Fischer in Jens.

TYNO Letture. By Dr. Phili. S. Tachulok. Verlag von Gustav Fischer in Jena. 1910.

There is much to be said in favor of a historical-critical book on biology. It has the merit of reconstructing the various stages of a scientific conception. This process of reconstructions of the process of reconstruction of the process of the control of the concept at the process day and how far does it next modern popular of the concept and the process of the control of the process of the process

THE AGE OF MAMMALS. By Prof. Henry Fairfield Osborn, New York: The Macmillan Company, 1910. 635 pp.; 220 illustrations. Price, \$450 net.

Fairfield Osborn, New York: Ine Macmillan Company, 191, 685 pp.; 20 illustrations. Price, 440 net.
Prof. Henry Patcheld Geore is the forement authority in this country, and probably in the org. Patcheld Geore is the forement of the foreme

A TEXT-BOOK OF GENERAL BACTERIOLOGY.
By Edwin O. Jordan, Ph D. Second
revised edition, 8vo. 584 pp. illustrated. Philadelphia and London:
W. B. Saunders Company, 1910. Cloth,
\$3 net

33 inct.
The book is profusely and well illustrated, and, since externals attle the eye first, it is pagings not not or place in vertewing the book to prake at the outset fix general arrelingment and technical excellence. The care which has been bestaged on these matters is but the outset ward symbol on the matters is but the outset of the content o

After an introductory chapter the author considers in order the technique of hacetridate, the considers in order the technique of hacetridate, the structure, development, and composition of heaters, the offect of physicial and channels agents upon them, and conversibly the effects produced by heaters of the order of physicial and channels agent upon them, and conversibly the effects of the control of the con

szcellent work.

Assistant Sucretary United States Draftment of Agriculture. London:
Kegan Faul, Trench, Trübner & Co.,
Ltd New York: Orange Judé Company, 1910. Pp. xii + 281. 281 illustrations.

kagan Faul, Trench, Trubner & Co., Ltd. New York: Ornage Judd Company, 1910. Pp. xiii+391. 221 liliustrations on the properties of the control of the cont

profinence, and other uneven season through the parties of rural life constitute the larger parties?

The house is the most influence and the control influence and the control in our entailment of the control in our entailment the case the farm home is rectailly our most important home. Farmers arrelater conversatives and are peculiarly loyal to the good of the community. The profit of the control in the con

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He also points out that the windy of enterior day among the fell point of fifther distributions are provided by the control of the security of enterior in part only search but it we contribute to the contribute of the enterior in part of the enterior in the contribute of the enterior in part of the enterior in the contribute of the enterior in part of the enterior in the contribute of the enterior in the enterior

mation."

He sime points out that the weaty of science as applied to agreealture is not only useful but intensity interesting, little farm work out of the drudgery into which it is actes allowed to fall, and is rapidly raising farming in the scale of vocations.

scale of vocations.

How Ir Fries. By Richard Ferris, B.S.,
C.E. New York: Thomas Nelson &
Bons, 1910. 475 pp.; 150 illustrations.

Price, \$1.20 net.

Bons, 1910. 475 pp.; 150 illustrations. Price, 31 20 met. In this popularly written book, Mr. Ferris has given rather a good explanation, for the large principles underlying the construction of averophene and attribute. In arrangement, his book differs not radically from the dosens of popular books which have been issued in the last year. There is the usual account of the monophane, as well as a brief history of light, the construction, operation and manufacture of balloons, dirighles and otherwise, a glossary, that some of the type which Mr. Forris tillustrates are now sid. Thus, the old Yoshin machine is limerated, and not the new, although the results of the side of the contraction of the Res. In monophase is askeded for description instead of the new type.

Instead of the new type.

How yo Know Architecture. The Human Elements in the Evolution of Styles. By Frank E. Wallis, A.A.I.A. New York: Harper & Brothers, 1910. See, 327 pp. Price, 32 net.

Architecture and building are covered in this book as two branches of one subject. The object of the submoder can be policip por thouse of the submoder of the

THE ELEMENTS. By Sir William A. Til-den. London and New York: Harper & Brothers, 1910. Pp. xi + 139.

den. London and New York: Harper & Brothers, 1910. Pp. 14 + 139.

Bit William Tilden has given us a brief and clear expection of the ideas which eventually observed the property of the prope

THE BOYS BOOK OF MODEL AEROPLANES.
How to Build and Fly Them. With
the Story of the Evolution of the
Flying Machine. By Francis A. Collins. New York: The Century Company, 1911. Price, \$1.20 net.

lina. New York: The Century Company, 1977. Price, \$2.50 net.

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THE BIG GAME OF AFRICA. By Richard Tjadler. New York: D. Appleton & Company, 1910. Syo.; 884 pp. Price, \$3 net.

Company, 1910. Svo.; 984 pp. crice, \$2 not.
Good books on hunting trips and advantures in the "Dark" Continent" are plantiful. The surface of the state of the surface of

HEIDE UND MOOR. Von Dr. Adolf Kast Stuttgart: Gesellschaft der Na freunde, 1916.

freunds, 1918.

Dr. Kesisch in one of the most rispus and likewise one of the heat theorem pays electric writers of Germany. In the witch lies before on, an executive cannot be which lies before on, an executive cannot be within the contract of the contract of the little moneyages found in the little moneyages found in the little moneyages found in the little moneyages for the little moneyages for the little moneyages for the little moneyages for market of heatth and moor.

Thus "Paccottant Wanterman"

THE "PRACTICAL ENGINEER" POCKET BOOK
AND DIABY FOR 1911. LONGON: Technical Publishing Company. New
York: Van Nostrand.

This pocket hook is so well known to arl engineers that there is hardly any need to comment upon it. A number of additions have been made to bring the contests up to date. The printing is not everywhere as good as might be desired.

The printing is not overywhere as speed as might be desired.

MAGICLARS' TRICKS. HOW They Are Done. By Henry Hatton and Adrian Plate. New York: The Century Company, 1910. Ser., 1944 pp. Price, \$1.00 net. 1910. Ser., 1949 pp. Price, \$1.00 net. 1910. Ser., 1949 pp. Price, \$1.00 net. 1910. Ser., 1949 pp. Price, \$1.00 net. 1940. Ser., 1940. Ser

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CONSTRUCTION OF INDUCTION COILS AND TRANSFORMERS. Compiled and arranged by H. Windeld Secor. New York: Modern Electrics Publication, 1910. 18mo.; 100 pp.; 72 illustrations. Price, 25 cents.

Price, 35 cents.

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In addition to exposeding coil theory and construction, interrupters, threatons, and trease coil and interrupters are given for making a large coil of this type, suitable for leaving a large coil of this type, suitable for leaving a large coil of this type, suitable for leaving a few Benezia. A lovel of the Time of Augustina. By Daniel Henry Morris. New York: Broadway Publica, 18,000 and 19, 1910. Sto., 361 pp. 11 giving me. 2

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ARP-CARPE LARVE. How to Mace Them.

By John D. Adams. Chicages: Popular Mechanics Company, 1911. Idens, 187 pp.; 16 designs. Price, 35 cents.

The aims of this handhook is to washe anyone to construct from paper, cordbowrd, and wood, with the aid of a sharp losis and a little saint and gias, really artistic lamps for the aid. It shows the porth, and to finding the lamps to foot-light chandidates. Price Arrivacesors. It stillabelies (Lee and Lamps to foot-light chandidates.)

lamps to four-light characterists. Chee, and Tree Autocontar. Its fielded fine, chee, and Use. By Robert Slees. New York: Outing Publishing Company, 1816, 184 pp. Price, 81.85 Company, 1816, 184 pp. Price, 81.85 Company, 1816, Incompany of the Company of the Company of the Sections and the Company of the Company of the Sections, but the Company of the Company of the Sections, but the Company of the Company of the Sections.

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PATENTS

Padentse nomined.

A Free Spatialem as to the prohable padents-tility of an investion will be readily siven to any property farmining us with a model or sketch and brief description of the device in question. All smagnifications are atriatiy confidential. Our firmid-fibers on Patients with the sect free on

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Frie dies. S. A. FOOL, SAY SA, EMBRAGEL, SAT OL-STER MONTRY WRITING SONGS. Thomsands of do-ing approach who can write successful words, or ma-d. Fast-apperience unnecessary. Send as your song colour. The restriction of the fast operation. The restriction of the property of the pro-cessor. The restriction of the property of the E. Eleksen Durghale Co., Dept. 3, washington, D.C.

RECOX PREUM ATIC CUBETON, an epoch maker, any sea for motor dryven vehicles and a fortune deer for the terresor. See Releasible American, Veh and many others. Investigation solletted. Cox tenantic Custions So., 78 Broad way, New York.

Processing Control to , we proceed a process of the control to the

PROFITS. Belling Vulcan Fountain and Stylo Well advertised, say to sell, Write for onta-liberal discounts. J. F. Ullrich & Company,

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CHRISTIFU AMBRICAN GOULD PERSE. I have a actical working model of a double powered system in eagines and promellers, embodying all require-ists accessary in quality for Gould Fries, with consense solicited from reputable parties with said "I interest. Working Model, Box 75, New York.

LR. Patent for trapping as fe robbers. Man-give me an offer on this. Patented Janu-

TEND.—Some one to handle Patent SELISE. An allo adding bridge whist songer, Can be manu-d for \$1.00 a piece. Address E. 200 First Avenue.

WANTED.

WANTED,

AL REPRESENTATIVE WATED.—Sphendid
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LISTS OF MANUFACTURERS.

INQUIRY COLUMN

CANDER IN

mirry No. 9918. - Wanted, the names and ad-

S. Tank we washing

Ruhmer's Recent Work in Wirel Telegraphy

Telegraphy
(Continued from page 280.)
Wireless telephony was mainly in the direction of the design of a suitable generator of higher constancy and which would be able to give out a greater energy of vibration. This is based on Ruhmer's are interrupter, vit, an election of the continue to give out a greater area interrupter, vis., an electric are connected up in series to a substantial blowing electro-magnet and in parallel to a vibratiory circuit. In opposition to Duddell's arrangement, the vibratory circuit bere is positively excited by the rhythmically working blower that interrupts the electric are. This method allows practically any amount of energy to be conserved into vibrations. Michelle the property of interruption, two nethods can be expected to the conserved into vibrations.

of the form to a sufficient frequency of the form two methods can be too for the form to the form t or generator, rea win nignetamon direct current. Laritempe affords the very composition of the explosive distance to be maintained absolutely constant for any length of time, thus making vibrations extremely regular, which in the case of area between earbon electrodes is not the case. The metal electrodes used in this connection are constituted by metal wires with square cross sections between the longitudinal edges of which the discharge is formed. These wires are present proof the proposition of the control o roo groover twin seigned as cooling ves-deta three electrical discharge is produced to three tectrical discharge is produced the wires, the length of the arc (accurately adjusted by means of a micrometer acres) being maintained constant by the continu-ally varying portions of metal between which the discharge is made to pass. At the same time is effected an excellent cool-ling of the discharge which considerably increases its activity, a substantial electro-inversace its activity, a substantial electro-targes are always altusted on the edges of the wire, any irregularity is effectually avoided.

Charges are any irregularity is effectually avoided.

This generator has been used with a number of tests made over considerable distance. In connection with the first example, the connection with the first example of the control o

These experiments in connection with which remarkable sound intensities could be obtained were continued in the following obtained were continued in the following year over greater distances, the transmitting station being transferred to the Brussels Palace of Justice, which on account of its situation and height constitutes an excellent antenna support. The high-tension direct

The New Rigid Dirigible of the English Navy. "N L" By Carl Diensthach

situation and height constitutes an excellent antenna support. The high-tension direct current was supplied by a high-tension ac-cumulator battery, and the receiving ap-paratus was installed successively at the Namur citatel (at fifty kilometers distance) and at the Liege Observatory, distant about 110 kilometers, a satisfactory transmission of conversation being obtained in both

cases.

Another experimental station for wire-less telephony has been installed at Ruh-mer's Berlin laboratory. The generator there used is fed from a high-tension ac-cumulator battery comprising \$,000 cells.

By Carl Diseastheach
THE Zeppelin Airship Construction Comresearch of means
I pany has always firmly refused to build
any airships for foreign countries, on the
air and the second of the second of

Triple the Purchasing Power of Your Money



DO YOU know that it is the health-giving pull of nature that makes every gingery water breeze, every glance at a beautiful lake or river, attract the red-blooded human being, and make him want a boat? It's your duty to yourself—to your family—to respond to this influence.

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Make \$1.00 do exactly the work of \$3.00

HOW? By purchasing the full-sized paper patterns and instructions for a boat, or by purchasing all or part of the material in the knock-down—that is—every piece cut to shape, machined and accurately fitted, so that it will go together but one way only—the right way.

You ask: Why does this method reduce the price? There are five reasons:

First: You are spending a few pleasant hours instead of money in assembling the boat, which reduces the cost to you over half

Second: You do not pay—but wait—space in this publication is mighty expensive. Why tell only part of the story? Our new catalog No. 25 goes into detail, and a postal card will bring it to you. It shows an extensive line of boats, from cances to cabin cruisers—every one backed by a guarantee of satisfaction or your money refunded.

Send that postal now-right now

BROOKS MANUFACTURING CO. 1703 RUST AVENUE SAGINAW, MICHIGAN

Q A HOME-MADE 100-MILE WIRELESS TELEGRAPH SET to American Supplement 1605 for a therough, clear description, by A. Frederick Cellins, Numerous adequate dis-pusy the last, Price, 10 cents, by saul. Order from your newedshirt or Munn O' Co., Inc., 361 Breadway, N Y

The Edison Storage Battery

is not merely an improvement over the old type of storage battery. It is a radical departure - absolutely different in principle and construction.

The result is a battery of half the weight of a lead battery of equal capacity or double the capacity of a lead battery of equal weight; a battery that is not subject to any of the ills of the lead batteryis practically fool-proof, requires

far less care than any other battery and lasts many times as long. If you are interested in electric vehicles, either pleasure or com-mercial—and bear in mind the electric is the cur of the agefor our new catalog.

Edison Storage Battery Co., 132 Lakeside Ave., Orange, N. J.

Build This Boat

at tree-half-coir. It's fam to build a boot yourself. And you can sake at leake the place of \$2. You need to you without a millier boot event though your means are limited. Your choice of sizes and types. It is no simple and easy any one can do it. All you need is a knocked down.

Pioneer Frame a set of our free plans and the rest is like setting

and the rest is like setting an assortment of blocks. Ploneer Frames are made of A No. 1 little cask, all set the part trued at our factory fore being knocked down for shipment, the one peffectly accurate. Each part rized to fit the other perfectly. You can possibly make a misstake. You do not a perfect motor hoter—joint beauty in line and setting the case of the

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Aliver, Nickel and metal
plating Prof Gray's new
electro machine plates on
watches, Jewoiry, tableware
and motal godds.

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want souds plaid.
LATERS HAVE ALL THEY CAN DO.
to bring t. You can hive boys to do the plains as
Men and women makine work for small per cont.
ta fine -no way to do it better. No experience
ped, we tenged yes. Recipes, Fermulas,
le Reprets Free. Outsite ready for work when
control of the control of the control of \$1.00 of plating.

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E. Dop't wait. Send us your address anyway.

GRAY & CO., PLATING WORKS,

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STEAM TURBINES.—THEIR constraint, Operation and Commercial Agriculture and Commercial Agriculture (Construction of Commercial Agriculture), 1203. 1204. 1207. 1208. 1209







AMERICAN SAFETY RAZOR CO.

underly building a series of pressy military dirigities for experiments; and another pro-pagate the English series begans by subscription the two little and title Possess siriships, the big "Clement-Bayler, siril and the new gipant (Tebaulay," and presented them to the government.' Bastellic and welsirelyis, the lay "Consent-shaped peer and them to the government." Belletic and them to the government. Belletic and them to the government. Belletic and them to the government and them to the government and the shaped and the sha

many a recording some exhibiting stables was a creeded at great expense for the sole purpose of terring the naval airship's propellers under the conditions that prevail in actual flight, and for developing the most economical type.

The English "N I," as the new serial dreadought is galled, has just been completed after remaining on the stocks for nearly three years. From the "Expeptions" on the work of the condition of the condition of the stocks for nearly three years. From the "Expeptions" on the condition of the condition o

Glycerine

Glycorine

Ming tilings in Sweden, an achevure minming tilings in Sweden, an apothecary
was making lead plaster, in the ordinary
way by heating olive oil with litharge and
water, when he channed to notice that the
liquid which was mingled with the pastylead compound had a strangely swede task,
On further investigation, he found that the
sweet task was caused by 'disc prisentee of
an oily liquid which was dissolved; in this
water. No such substaines was described
in the books of the day.
Scheele, the apothecary, knew, that he
had discovered a new substance. The some
found that this sweet liquid's rest of the
product of olive oil along this days water.

saint and fets would place to as same treatment. So he named "sweet principle of facil," or "bale More than a century has passe Schecker discovery, yet it is but all after years about the contract of the co shity years since "sold-squar" the county in the of practical values, compet the avery limited use in nescicion. Chansille, have given it the more formal name of girsteins, derived from a Gresk word meaning awest. Every, one today is familiar with the clear, thick liquid so commonly used for tollet purposes. Its southing and softening effect on dry or inflanted skin is the quality for which it is best known in most households; but few people have any lides of the variety of purposes to which it is applied.

Among its most striking and valuable properties are its genet solvent power, its chemical stability, and its sweetness. Moseover, it is digestible, will not cruporate, and owing to this and the hardening of materials with which it is mixed.

These peculiar qualities make it most

qualities, will prevent me uryang sambardening of materials with which it is missed.

These peculiar qualities make it most valuable in the preparation of medicine, unquent, and various food products, as preserves and mustancis; likewise in beer, wines, and other bottled goods, where it is said to act as a preservative. The fact that strong solutions of givernes and water will not beened in the lowest winter temperatures has caucacle its use is the temperature in the contract of the contra

heavier than water. After long exposure to a freezing temperature, glycortine will deposit rhombic crystals resembling those of sugar candy. Its boiling point is 460 deg. F. Pare glycortine will burn readily if first heated to about three hundred degrees. If gives a pale blue fismes eimilar to that of alcohol, and to the chemist it

to that of alcohol, and to the chemist it is an alcohol.

There is a process by which animal fats are directly decomposed into tearler acid and giyerine, by subjecting the fat to the action of super-heated steam, at a temperature of several hundred degrees. The resulting giyerine is condenstrated, and purified by steam distillation, while the steric acid, which much resembles wax, and in no way answers to our ordinary conception of acid, is in great demand for candles.

Starch in Papermaking

Starch in Papermaking
STARCH is commonly added to the
pulp from which writing paper is
made, for the purpase of rendering the
paper less absorbent and presenting the
first of the particular according to Le
Nature, the conditions of this admixture
have been minutely studied by M. Trequalt, who has found that the best results are obtained when the starch is
added in the form of an imperfect paste,
with its grains still supersisk, though
softened by the action of the water. In
this condition the starch grains readily
and the first of the starch grains and
other fillers which are commonly added.
The starch may be replaced by the misture of the formic ethers of starch, which
is sold under the name of reculses, and
which may also be substituted for gelstine in the preparation of costed papers.

An International Carat

An International Carat
THE cash, the unit of weight for
diamonds and other game, has various
values in different countries and a legal
value in none. The Debth caret,
formerly 90.50 milligeness, is now 98.45 milligrans;
the French 90.54 the filelink, 90.400 the Arabias, 98.45, and the
Bolognese, 188.5. In all, 51 different
values of the caret are unsignabled. In
consequence of this countries, guest-basers
and oven vanders are after the state of the
only disheased absents one has a

and over venous or housing any housing in only distance dealers are less than a large and the large





Use This Portable \$1



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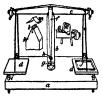
and from H, with a radius HA, describe an are AL, and the chord of this are is the side of the issertibed pentagon, which may be set off first times around the circumference as a chord. This problem is usually given in books' of mechanical drawing.

(13297) W. H. W. says much discussion conjured side the saybolon at Communipace as to Bie sibect it would have had upon an acropage 3,000 feet distant, at an altitude of the says of the

them, the acceptane would not receive a shock that would wannage it.

"(188855 M., do. adver. While residing your being of Chelin 1864, Led. 1, nontroot an appropriate of the control 1864, Led. 1864, Incation an experience of the control 1864, and the control 1864

considerable are symbol. We also there is an advisible matter than an advisible matter of the control of the proteins of the p



caghes dissectioned going at full speed with the labout proposition. As a first we can be compared to the serve of the compared to the compare



MR. HANDY-MAN'S WORK-BENCH

"RUNS LIKE A SCARED RABBIT" -Write Chierne Gredy, Mesignmery, Ala, who while yet a green hand at motors averaged like inline per hote on a f. of mile river crip

Perfection Marine Motor Perfection Marine Motor The "Principle" is a wordy of the same "I needs little attention. Just a regular of the principle of the same "I needs little attention. Just a regular of the same "I need to the same "I need to the same of the

MULLINS STEEL MOTOR BOATS

HI Motte, \$4 and \$8 h., \$600 mp? I hand \$8 h., \$15 mp. All the cipin, all the right and the first process of the second form of



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How it is contrayed, how much it will cost, it is practicely
from an erribational and equipment studeout? These and
from an erribational and equipment studeout? These and
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SALESMEN WANTED

Trained Sensons sure from \$1,50.00 to \$10,000 a year, and exposes. Hundreds of the state of the

About Remembering

By ELBERT HUBBARD

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anywhere Women can operate Comes com-plete Ten exclusive revolutionising fea-tures. PEEE TRIAL F 1 1 No obligation till satisfied 18-year guarantee "He gine Facts" from y write for 1// ELLIS ENGINE CO. 53 Mullett St. Detroit, Mick. 3-121:

BARKER MOTORS -1 16 to 10 H. P-E C. L. BARKER, NORWALK, CONK.









Grow Mushrooms





Electricity

Telephone Line at Panama Casal.— The telephone line across the Isthmus of Panama, following the Panama Raliroad, is being strung on poles made of old steel rails. The rails are 28 feet long, and are set in concrete bases.

New Volt Adopted by France.—The new volt, based on the standard Weston cell and recommended by the International Committee, has now been adopted by the United States, Germany and France. The Cinico States, Germany and France. The change in France has only just been effected. Owing to the fact that the former voit used in France was based on the Clark cell, but the temperature of the Clark cell was not given, it was a simple matter to adopt the new value of the voit by merely specifying the temperature of the Clark cell, which would give a value sould to the same which would give a value sould to the same the contract of the clark cell. ch would give a value equal to that as-

Signed to the weston call.

Electric Lamps for Miners.—There appears to be considerable activity in Germany in the development of electric lighting outfits for miners. These consist usually of a small lamp, with a storage battery weighing from 2½ to 6 pounds, and capable of storing unflicient current to energies the lamp for from a few hours to a full day. Primarily these lamps were declared. day. Prunarily, these lamps were designed for the use of men engaged in mine rescue work, but it is found that they can be used economically for general mine work.

It is said that there are seventeen kinds of electric miners' lamps now being manufactured in Germany by eight different

Rust and Electricity.—Contrary to ex-pectations, the wires of a fence which are farthest removed from the ground are more apt to rust than those which actually run apt to rust than those which actually run through the dew-laden grass. In an effort to explain this phenomenon, Mr. M. L. King, of the Agricultural Engineering Department of the University of Iowa, has made an investigation, disclosing the fact that a current of electricity is commonly to be found in the lower wires of fences, this current constitute of the control of the contro to be found in the lower wires of fences, this current sometimes amounting to 0,001 of an ampere, with a difference of potential of one rolt between the wire and the ground. No such currents can be detected in the upper wires. It is Mr. King's opin-ion that this current account for the pres-ervation of the lower wires against rust.

Electrical Show at College. -- In a recent lauce of the Scantine Antanca we referred to the increasing number of electrical shows and their success, also to the fact that in a number of cities they have become a permanent annual feature. We should have mentioned in this connection the annual electrical shows held by the Muchigan State College at East Lausling, Michigan. In the second week of March, or his permanent of the control subject that will receive considerable prom-mence is that of illumination, and examples of the best methods of lighting bed rooms, dhing rooms, etc., will be given. The il-luminating engineer has had so much to do in solving problems of illuminating public buildings, industrial buildings and the like, that heretofore the home has not come in lor as much attention as it should have

Towing Locomotives for the Panama Locks.—The plans have recently been com-pleted for the locomotives which are to haul ships through the locks of the Panama Canal. These locomotives will be decidedly novel in construction. Each locomotive is in consist of these sections a central seatton Canal. These locomotives will be decidedly novel in construction. Each locomotive is to convist of three sections, a central section containing the cable drums for the two line, and a traction section fore and aft. The central section will be connected to the end sections by means of universal joints. The locomotives will be obliged to climb from the lowers to the contral section. sections by means of universal joints. The locomolives will be obliged to climb from the lower to the upper tevel of the lacks of the control of the local section of the local section of the local section will also be provided, to bear against the sides of the rack so as to overcome the lacetal pull of the tow line. Each traction section will be provided with a 75-horse-power motor, and current will be supplied from conductors placed in a conduit at one side of the track. The maximum pull of the pull control of the pull

Engineering

Total Work Done at Panama.—The grand total of excavation already done on the Panama Canal up to February 1 was 199,138,400 cubic yarda, leaving to be ex-cavated 63.596.560 cubic yarda. Total or-cavation for January of this pear was 2,772,170 cubic yarda, as compared with 9,831,899 cubic yarda in January of 1910.

8,881,989 cubic yards in January of 1910. Canadian Railread Construction.—Canada has been a center of remarkable rall-road activity during the past year. The Canadian Northern led with the construction of 484 miles of road. The National Trans-Continental built 437 miles the CanTrans-Continental built 437 miles are in course of construction.

this, \$101 miles are in course or construc-tion.

Record Trans - continental Trip. — A special train has recently made the trans-continental trip from Yuma to New York, course a director of the Course of the New York, 975 miles, was made in 1,000 minutes. The total cost of this special train, which was run for a medical con-sultation, is stated to have been \$7,100.

Ex-devenae of Structural Timber.

sultation, is stated to have been \$7,100.

Endurance of Structural Tlinber.

Some experiments of Mr. C. P. Buckanan
on bridge timbers which have seen \$8,
years of service seem to prove that there is
no necessary deterioration of structural
timber which has been properly protected.
The tests which he made show that bridge
timbers which has been a quarter of a
red pieces of timber a year old, which had
been passed as first class building material.

We Build Wearshes Bearder.

We Build Warships Rapidly.—To-day, warships are built in the United States in warships are built in the United States in not much more than half the time required tron or affects years ago. Clef Constructor Watt attributes this increase in rapidity to greater familiarity with government work on the part of contractors, to the provision of more complete plans by the Navy Department, and to the effort to restrict changes in contract plans as much as possible. Ton for ton, we build as quickly as the foreign navies and actually for leas coat.

for less cost.

A New French Submarine.—The latest French submarine is provided with an engine which is used both on the surface and in the submerged condition. This result is secured by a special system, in which the heat is stored up and subsequently utilised when the vessel is beneath the surface. The French claim that the triats which have already taken piace show that this vessel is capable of an under-water speed much greater than can be obtained by means of the accumulators which are used on other submarines.

submarines.

British Dreadmought "King George V."

—Hitherto British dreadmoughts have been of smaller displacement than those of some other navies. The latest to be laid down, however, the "King George V." is well to the front, with a total displacement of 35,000 tons normal. She is 370 feet mean draft. The speed of 21 knots. She will carry ten 134-inch guns in five turrets, all on the center line, together with a torpedo defense armament of twenty-four 4-inch guns.

The First Old-driven Ocean Vessel.—

ment of twenty-four 4-inch guns.

The First Oil-driven Cosan Vessel.—
The credit for building the first occan-going vessel fitted with reversible Diesel engines should be given to the Dutch. This vessel, the "Vulcanus," built by the Netherlands Shipbailding Co., Amsterdam, for "the Anglo-Saxon Petroleum Company, is 196 feet long by 3f feet beam, and she can carry 1,000 tons of bendise in bulk at a speed of 8½, miles per hour. The motive power consists of a 4-cycle Diesel engine, with ski 16-ind-yilhaders, using crude Tara-kan oil. The consumption is 3½ tons of oil per day of 34 hours at full speed. oil per day of 24 hours at full spe

oil per day of 94 hours at full speed.

Strength of Materials in Columns.—

Mr. J. E. Howard, of the Buress of StantonMr. J. E. Howard, of the Buress of Stantoncreative strengths for the stanton of the stantoncreative strengths for the stanton of the stan

important and Instructive Articles on Aviation

In the Scientific American Sup-plement we have published in the past fow years paper by some of the more cannent physician and engineers on fiying machines. No book thus for published is so complete and so authorisative as these articles. The range of the articles is wide, covering as it does the theoretical side of aviation as well as those more passicial speech which deal with the construction of machines. The following is a par-ticle which have appeared in the scientific American Supplement; see special note below.

see special note below.

9 1616, 1617, 1818, 1819, 1820, 1821

90 1627. The Procedon and Theory
of Avidation. In Growe Cardend London
part of the Procedon and Theory
of Avidation. In Growe Cardend London
part on explaint that he price of the part of the part

paper consumes — wight Asseptane. This is a thorough description of the eld type of Wright biplase with the horizontal elevation redder in the frent of the machine. Excellent diagrams and photographic views accompany the paper.

graphs: views accompany the paper. If 1756. Les II is Bléritot and His Barroplanes. Few people resides that Barroplanes. Few people resides that Barroplanes. Few people resides that the people resides and the people resides and the resent accomplished blent mesoplane, illustrated with diaguans and photographs. A complete description of the Farman Biphane, with deal darwings of the branch people residently and peopl

q 1767. The Santos-Dument Mone-plane. An flustrated article describing the Demoissile, the smallest and one of the fastest machines that far made. Statches accompany the article, showing the details of the construction and control.

9 1562. How to Make a Glidding Machine. Full details and drawings which will enable envous to make a glider for \$15.00.

¶ All these article

The containing all the articles above mentions will be mailed, and you can order as many of them as you wish. A set of papers containing all the articles above mentioned will be mailed for \$1.20.

SPECIAL NOTE ¶ We will mail [gratis] a list of many additional

important papers, in the Supplement, treating of aeronautics. Ask for list A

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B. MYRON H. LEWIS, C. E., and ALBERT H. CHANDLESI, C. E. Outero, 436 pages, 126 Biotro.



It is a standard work of reference covering the various use of concrete both polymers, including the various use of concrete both polymers, including kinds of cement employed in construction, concrete architecture, impection and testing, waterproofing, coloring and painting, reles, tables, working and cost data. It is a thoroughly practical work, clearly written, systematic and logical in its arrangement, broad in its scope and gives a lucid explanation of, and a clear insight into the fundamental principle employed in concrete design and construction. The practical value of the book is enhanced by over thirty-five useful tables, and concine statements of rules and methods.

Drop Forging, Die Sinking and Machine Forming of Steel

By JOSEPH V. WOODWORTH, author of *De Thate Construction and Use, * Punches, Dass and To for Massifacturing in Presen, *etc. Octavo, 340 page 300 litutesitons. Prior, \$2.80.



¶A complete practical treatise on the hot and cold machine forming of steel and iron into finished shapes, to-gether with the gether with the tools, dies and ma-chinery involved in the manufacture of duplicate forgings and interchangeable hot and cold pressed parts from bar and

sheet metal. It is a comprehensive and modern work, written by an expert, and treating fully on modern shop practice, pro-cesses, methods, machines, tools and details.

Standard Practical Plumbing

By R. M. STARBUCK, suther of "Modern Plus Shuttrated," etc. Octavo, 406 pages, 347 Shuttr Prints, 82,00.



¶ This is a complete practical treatise and covers the subject of modern plumbing in all its branches. It treats

everyone working in any beanch of the plumbing trade. A large amount of space as devoted to a very complete and practical treatment of the subjects of hot water supply, circulation and range boiler work. Another valuable feature is the special chapter on drawing for plumbers. The illustrations, of which there are three hundred and forty-sersen, one hundred being full page plates, were drawn expressly for this book and show the mean modern and best American practice in plumbing construction.

Aeronantica

Aeronautics

A Safety Paractute for Aviatora.—M. Hervieu has just brought out a new parachute that folds in a small space behind the aviator and that, in case the aeroplane capsises or plunges to earth, quickly opens and Jerks him out of his machine, no matter in what position it may be. A dummy weighing 100 pounds and seated in a Bleirot for the Biffel Today was revently launched off the Biffel Today was revently launched off the Biffel Today was revently launched of the Biffel Today was revently launched over to the aerial authorities of the Biffel government by the Royal Aero Club for the use of naval officers' training in aviation. The army has also acquired a Paulian biplane, which successfully underwent its acceptance texts on January 11th, at Buc, flying for two hours that the summary 11th, at Buc, flying for two hours in a St-nile wind and gloling to earth with the engine stopped from a height of 600 feet. The meather was undemaged.

A New Monoplane Speed Record.—A new yneed rocotion error acceptance of the summary was record over a civilar course, of

fert. The machine was undamaged.

A New Monoplane Speed Record.—A new speed record over a circular rourse of the exceptionally small circumfrence of 25 kilometers (1.55 miles) was made on the 13th ultimo by Busson. This aviator heat all records up to 40 kilometers, but was obliged to descend after completing 48 owing to fog. He drove his DependussIn monoplane at the rate of 38.85 miles an hour, thus beating Louis Dreguel's military biplane record of 3940 for 40 kilometers (24.85 miles) by 4 monutes 01/2 seconds. His average speed was 52 miles an hour faster than Breguel's despite the fact that he flew over a much smaller circular course. Recent Fatallites in Germany and

Indeer than integers, accepte the next many he flow over a much smaller clevular course. Recent Fatalities in Germany and France.—On the oils ultimate the control of the c since a some regime with La Torte as increasing more of the making a heartiful glight of an hour's distribution, the throttled down his motor and made a sharp glide to earth from a helph of 400 or 300 feet. M. Summer made a snapshot of him when 500 feet from the ground. Just after this the machine dove sharply and struck the ground with terrific force. Notl had been warned the day before not be glide down at so sharp an angle, and it was failure to heed this warning that cost him and La Tortec their lives. Even with front and rear horisantal rudders some machines cannot be righted when they are directed earthward at too sharp an angle and the center of pressure moves far to the reur of the planes.

The Crew of the "Buchard."—The plate.

too sarry, an ange not seen of the planes.

Some moves of the "Suchaea". "The plat of the "Suchaea". "The plat of the "Suchaea" is Captain decreless, of the German army, alleened quited of spherical balloons, who took part, though not as plot, in the thirteen hours' flight in a dark stormy night across the North Sea, from Munich to the Orkney Slands, in the balloon "Touring Club." During this thirteen hours between ky and water the three balloons and too the condition of the number at the condition of the sumber a struck by a large wave in the darkness. As Capt, Joerden went safely through such an ordeal, he is looked upon as "mascot" of the "Suchaea". He is now receiving instruction in the piloting of dirighthe balloons with the Parascal Company, and will make a!

Science

A Meteorological Station in the Antarctic.—There are persistent rumors that the Australian government is planning to establish a meteorological station on the establish a meteorological station on the coast of the Antarctic continent, to be con-nected by wireless with Australia and New York and

Zealand.

Black Boow, —A case of "black" snow that occurred recently in the lower Emmen Valley. Switeraland, is described in Nature. The snow was not black when it fell, but was followed by a fine rain, and then by a freeze. A crust of pure ice was thus formed, beneath which was a small alr-filled space, and the light when reflected from the snow beneath produced to the eye a dark appearance.

Further Emploration by Shackleton.—

the eye a dark appearance. Further Exploration by Shackleton.
Sir Knreet Shackleton is to head an expedition to Spithergen during the coming apring. The party will number six, including some numbers of the "Ninrad" expedition, and will undertake hiological and geological rearraches. Shackleton is planning to organize later an expedition on a large scale to the Antarctic. The program includes a general circumnavigation of the Antarctic continent, and it is proposed to land three parties, of nine men each, at Cape Adair, Sabrina Land, and Enderby Land, each with complete stores for two years. These parties are to work inland over the great ice cap.

Apparatus for Measuring Snowfall.

induced years. In the parties are to wars inland over the great ice cap.

Apparatus for Measuring Snowfall.—
The United States Westler Bureau has just published a new and enlarged edition of the pumphlet entitled "Measurement of Precepitation." This edition, as compared with the comparation of the pumphlet entitled Measurement of Precepitation. The continuer management of the particular of the problem and others. The problem of correctly measuring the heavy snowfall of mountain regions has an important bearing on irrigation problems, and is being actively studied, not only in America, by the Weather Burwau, but also in the Alps, by the official meteorologists of Switzerland.

Haller's Comet and Atmosphere Dust.—

Halley's Comet and Atmospheric Dust.—
Dr. John Altken, inventor of the dust counter, and litera, inventor of the dust counter, and literal inventor of the dust makes and healists of the atmosphere in the mess and healists of the atmosphere in the time of the passage of Halley's countries of which have just been pulsibled. The atmosphere was found to be abnormally dusty during tust been pulsibled. The atmosphere was found to be abnormally dusty during the presence of anticyclonic conditions, and Dr. Altken suggests that this may have been due to the downward movement of the air under such conditions bringing down dust from the upper atmosphere. That the unusual dustiness of the upper atmosphere thus indicated may have been due to the comet is a natural inference, but, as in all the other investigations of this disappointing comet's effect upon the atmosphere, the verdict must be "Not proven."

The Meteorological Service of Madagas. Halley's Comet and Atmospheric Du

The Meteorological Service of Madagas car,—In a lecture before the Meteorologica Society of Mauritius, Father Colin, S. J The Meteorological Service of Madagas.
The Crew of the "Suchard" is Captain Joerdens, of modem planning in all its branches. It treas the subject of the "Suchard" is Captain Joerdens, of the Suchard is considered to the saidled work of the plumb for and the plumb for and

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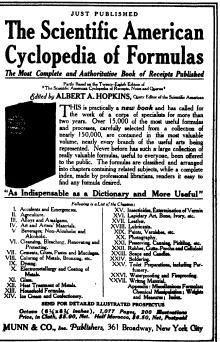
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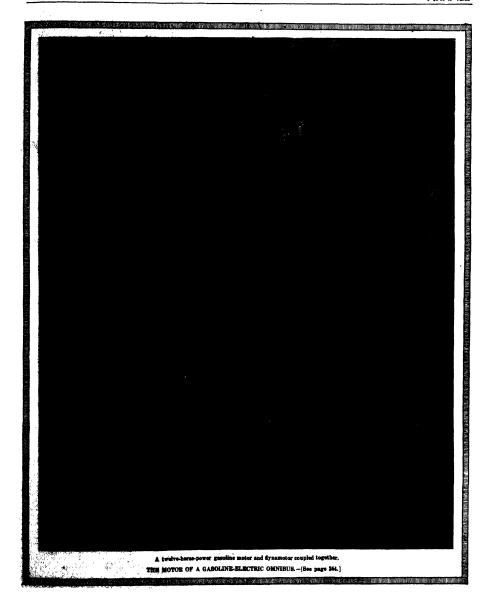
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CO.]

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NEW YORK, SATURDAY, MARCH 11, 1911

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The belitter is always glad to revelve for examination illustrated attacks on subjects of timely interest. If the photographs are start, then art has short, and the facts autherite, the contributions will reverse use call attention. Accepted articles will be paid for all reliably always at the paid of all reliably always are proportionally always.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science

nted—An American Atlas

BOUT ten years ago the government of Germany began to build, in its "leased" territory of Kinochau, on the China coast, a great sea-A not known, on the China coast, a great sea-port town—Tsingtao (or, as the Germans write it, Tsingtau"). They selected for this purpose the site of an old Chinese village, and retained its name, which means "green islands." For the better part of a decade the town of Tsington has possessed a threefold claim upon the

attention of the world-as the terminus of the Shantung Railway, as a port of call for several lines of German, British, and Japanese steamships, and as the seat of government of a thriving German colony. Millions of marks have been spent on the wharves and docks, hospitals, administrative buildings, fortifications, shops, offices, clubs, and dwellings of this. fications, shops, offices, clubs, and dwellings of this, the most important German settlement in the Far Rast, In 1907 Tsungtao had a population of 1,848 Europeans, 171 Japanese, and 81,800 Chinese. In the same year its imports reached a value of 880-48,988, and its exports 81,14,88,817. The ships entering the port numbered 499, with an aggregate

of 516,848. Let us now open the largest and latest atlas issued by the best-known map-publishing house in America—conspicuously dated "1910" on the cover and title page—and seek for Tsington. We do not find it! We find a map of the China coast, drawn with a we find a map of the China coast, orawn who a crudity of outline that is apparent, even if we do not take the trouble to place this American commercial product alongside of the authoritative official charts of our own and foreign governments. Even the oring of the map offends our eye by failing to ister" properly, so that the green hatching of the land extends some ten miles out to sea at one point and retreats ten miles inland at another. The Kiaochan protectorate is shown on a scale so large that space is found within it for recording the location of five unimportant Chinese towns and villages. But

of Tsingtau not a trace.
All this is illustrative, and serves to explain why All this is illustrative, and serves to explain why culvated Americans long since ceased to take the American-made allay seriously. The American atlas is made to self, and unfortunately it does self to the undiscriminating majority. The fault lies with the public, not with the publicher. Better things are demandled of the publisher abroad, and the result, so far as unofficial map, making is concerned, is seen in the beautful and authoritative atlases of Stieler, Berghaus, Debes, Bartholomew, Stanford, and Keith Johnston.

"Having Eyes, They See Not"

In spite of the emphasis that up-to-date pedagogy lays upon the training of the powers of observation, it remains true that the aretage man is decidedly blinder than the much-maligned but to the details of almost every picture in Nature's gallery, whether by land, or sea, or sky.

whether by land, or sea, or sky.

Suppose a new star, as bright as Sirius, made its appearance in Bootes, or Andromeda, or Cygnus.

Suppose Sirus himself vanished from the firmaneral How many people would notice the change in the celestial picture? Suppose, by some stupendoms miracle, all the stars were shifted about, like the bits of glass in a kalcidoscope, and grouped in new

constellations. How many men of the class that calls itself "educated" would, from personal obser-vation, gather the slightest inkling of what had taken

values, games the supposed initing of the colors in the ratio-boy age, can tell the order of the colors in the ratio-low? Most of us once acquired this list of informa-tion from a book, and specially forgot it; for the in-formation was never verified and inted in our minds by an examination of the ratio wheel.

Discount of the Fairnow 18811.
Vicarious observation is an indolent habit common to all classes. Scientific men are prone to it.
Even painters, who, so to speak, live by their eyes, are, as Ruskin has rehemently told us, blinded by convention to the most obvious facts of Nature. The lessons of Ruskin, and of others who have presincerity in art, need to be reiterated to-day. The creacent moon is still frequently palitied with her horas turned to the west; notwithstanding the fact that this particular piece of imbedility on the par-of the artists has been denoused again and again. The midnight sky is still shown with its stars seat-tered about wherever the captice of the artist chouses to put them. To one who knows the con-stellations no amount of beauty in the examende can save the effect of such a picture from being grotesque. As well represent a lexel of cuttle adorned with wings, or the Madonna with a super-floous nose. sincerity in art, need to be reiterated to-day.

Frank conventionalising is well enough. No one Frank conventionalising is well enough. No one expects the flowers in a wall-paper pattern to have much in common with those depicted in botanical textbooks. But art that appires to be more than decoration cannot profitably dispense with the knowledge derived from accurate observation. The distinction lies in the fact that the conventional deabsunction lies in the fact that the conventional de-sign does not pretend to portray Nature, while the painting of impossible moons and stars does; and we are repelled by the display of the artist's ignor-ance, or perhaps by what we feel to be his assump-

John Burroughs has pointed out that American pocts are prone to pervert natural history by trans-planting the fauna and flora of Europe across the Atlantic. The skylark, of heavenly voice, is a part of the port's stock-in-trade; but in a poem the locale of which happens to be Iowa, or Nebraska, or Tennessee, he is exactly as much out of place as the roe or the dodo. Some of our poets appear to think that he is, to all intents and purposes, the same thing as the meadowlark—they are both "larks." This is like expecting pineapples to grow on pine trees.

Nature lies close about us, from infancy to old

age. Books are not wanting to enable us to inter-pret her. In fact, the literature of Nature is just now enjoying an unprecedented vogue. The books are indispensable, even if they serve no other purare interpression; even it tue; ever in deep purpose than to supply us with our vocabulary—to enable us to name what we see. But let us not trust to books alone, or chiefly. Let us use our eyes. Let us apply the great art of observation, instead of merely preaching about it.

Linking the City Sewer to the Farm

HIMING THE CATY NEWER AND USER FARCES.

HEN New York City is now geographic—
ally described as "a city surrounded by sewage," and Chicago is sending her aewage down to St. Louis, se grosse, and St. Louis is depending upon its oxygenation, during the flowage, and on settling and filtration beds; and when New York's river and bay bottoms are estimated to hold

Yorks river and bay bottoms are estimated to hold swags colids a foot or more shiele, we certainly are confronted with a condition not with a theory. The New York 'Smittary Commission and some conservative and skilled engineers are giving the savage problem much attention. If the sewage can not indefinitely be sent down he bay, at the rate of seven, hundred million gallons daily, to be carried back and forth with every shifting tide, then where is the solution?

When Liebig and Crookes bewalled the canuals loss of millions of dollars of sewage sort into the sea instead of being utilised upon the farms, describing it as the great erime concentie of moders chyllicing it as the great erime concentior of moders chyllicing it as the great erime concentior of moders chyllicing it as the great erime concentior of moders chyllicing

ing it as the great crime economic of modern civili-sation, they did so with good reason.

sauon, trey due over good reason.

Commissions are sitting in session studying how to
increase our wheat yields, and when our average
yield per acre is 13 bushels as against England's
82 and Germany's 85 bushel average, there is need
for it along the lines of reducing the higher cost of

for it anong to many agginithms, living, Introsing farming will solve many agginithms, Introsing for the problems confronting us to-day. Instead of the 160-cere farm, the 20 or 40-acre farm, tilled to the limit of intelligence, industry and fertilization, and yielding more seveness than the larger arms is 20

The "Wheat King" and "Cattle Resea" here had their day and the five, test, and twenty-stere farm has come to stay. It was the maches hamiltoniated

former who from his navings studied the Thield government to pay off the unboard of Cassass an indomety in record time. The French possible, who indeputing pullivated his farm and gas every sensor of preduce the earth could be made to yield, acres

samming in record case. An arrange assess, was almosticly calitizated his farm and gail every consistent of passive the earth could be made to yield, saveil the day financially for France.

The days of 100 and 660-recovery and the same made an average yield of 18 bushels to the noise missis case and better conditions rule. The wheat farmers with a same property of the lastest of all farmers, must at last give his soil a "square deal," rotate his crops, and refertilize his land. The ruling method of cropping wheat year after year from the gradually nitrogen-exhausted coll must cease. Three is little virgin peacife land still to take up and begin cropping wheat year some case. Three is little virgin peacife land still to take up and begin cropping wheat few rows. The fact stands this from a nitrogen five soil runcessful wheat growing incassed he followed. Objects, the must challing value in wheat, a nitrogenous body, and it must draw from the infrequence for the transparence of the land. Liebig demonstrated the wildly of coinciding the sever with the farm in an experiment with the farm in an experiment inside years ago in the Jardin des Flants. He massured two stands of growing wheat, one with cow's manner, low in nitrogen, the other with human trine, wich in nitrogen, when the wheat was analyzed the former along the peace of the contract of any light of the day were contracted or through the provider of the contract of the provider of the stathel. Accommence of an a high as 12 pounds to the bushel. Accommence of an a high as 12 pounds to the bushel, if the Lishing experiment could be made to hold good in provided, expertinent context to the bushel, if the Lishing experiment context to our wheat to the bushel, if the Lishing experiment context of the context of our wifest to the bushel. It is not the context of the contex

be made to hold good.

The importance of increasing the gravenin our wheat may be pointed out in a convin our wheat may be good stock may average 20 and fibrin, call it an in our wheat may be pointed out in a convincing comparative way. Round stock may average 80 per cent of protein, albumen and fibrin, call it animal "gluten" to the pound. If stock be 25 cents per pound, then the reconstructive tissue of the steak, the real food, muscle value, coats us \$1.25 per pound. The comparative value of wheat gluten and animal "gluten", represented by the lean of the roast or the steak, physiologists undoubtedly would prefer the wheat gluten, pound for pound, because of its digestibility for other digestive and physiological reasons.

But if such a thing were possible to get 30 per cent of gluten from a barrel of flour costing \$6.00,

But if such a thing were possible to get 30 per cent of gluten from a harrel of flour costing \$6.00, then discarding the starch as an energy producer, and confining one's self to the flesh and blood element in the flour, the gluten, it would cost but 10 cents per pound as compared with the animal 'gluten,' the albemen and fibrin, at \$1.20 per pound. Millions of dollars in sewage value, nitrogenous fertilizer, are being wasted annually. Would the increasing of our wheat yteld 60 per cent to 100 per cent, and perhaps the increasing of the gluten content \$25 per cent and upward, represent a value in dollars and cents sufficient to warrant a linking of the sewer and the grain field? And what problems does this linking up mean to the anginee? He must adve the problem of newage disposal by either hipe-lining it far out to sea or in either a siquid or y state transferring it where it will do the most good, to the farm. The matter scoss to be now up to the santary engineer, and with the above figures applied to our wheat and grain crop, to say nothing of other farm products, it is something for the engineers to think over.

The New Oceanographic Institute at Paris

The New Oceanographic Institute at Paris
THE official opering of the Oceanographic Institute took place recently at Paris. It will
fill the took place recently at Paris. It will
the remembered that the institution was
founded by the Prince of Noraise and the
present building was donated by him to the
University, together with a large candownset
fund. It is a handsome cilifice of several stotics, erected in the university quarter, and constants
a mumber of Isboratories and iscture vicons for use
in oceanographic work. The similar oceanographic
Isboratory of Monaco will work conjectify with it,
and Paris will now be the headquarters for the somdays that the isborators in connection with feest the somdays and Faris will now be the soften with the size
that is substituted in the soften and in the secretary of the somchief conserved and the secretary of th

Giant Girders in the New Municipal Building

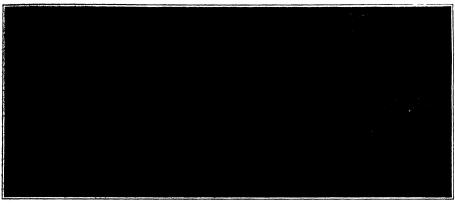
Hauling 50 Tons of Steel Through New York

O'I's readers will have beard through the daily papers of aone of the difficulties which arise in the transportation of the great girders that span the arch over Chambiers Street in the new Municipal Building now model reservation. The task of hauling a doesn fifty-ton girding from the Buttery through the streets of New York to the building afte is not to be spoken of lightly Our fibutrations give some idea of the magnitude of the

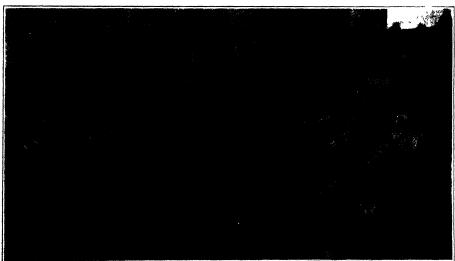
Rangi Mart

ing 10 feet in depth and 47½, feet in length. They form the supporting structure above the arch over (hambers Street, on the level of the fourth floor. I here of them are united into one body, which will carry, a load of some \$000 tons when the building is completed. Our day is the day of gigantic enterprises, and our city the city of gigant buildings. The new Mankipal Hall which is rising upon the site at the foot of Brooklyn.

below the street line. Approximately there are three unless of piping, with 117 hose connections, twenty-four roof hydraxis and twelve flush hadrants. It is fire brigade organization comprises twenty two men, divided into three companies set has we gue company sheem cal engine company, and shandpip company. In addition, the min, who are septered at all fires in advance of the regular company as are especial.



Hapling one of the eighers from Pier I to the building site at the foot of Brooklyn Bridge.



Preparing to unload the 50-ton girder. GIANT GIRDERS IN THE NEW MUNICIPAL BUILDING

transpoints in problem involved. The girders have to be treated was by one with a team of some thirty four barses. Fortunestry the route is almost a straight line. For the operation of turning convers with such a train and finds would present no slight did cult The police rejudations do not ordinately allow the passage through the straints of tweets numbering much over a down borses, which is convent of tweets numbering much over a down borses, which is the straints blanching of the trails which would install. For this passes the work of hamilton has to be the series between the work of hamilton has to be fore up a figurity-owne-half of the task having here a completely was compeled on fixery his Dry owned the series of the first formed yet Personal which the pre-arbitration for healting the price of the series of th

Bridge will be a fitting representative of the spirit and substance of New York, a spirit which may be said to find its expression even in such "details" as the fifty-ton girders under which the traffic will pass in safety through the very heart of this great (its

Manhattan's Firewall

Manhattan's Firewall

A from Ninth to Seventh Avenue, has been completed
the construction of the Penervivania station and adfacent buildings, and insurance engineers say a confaggation such as west experienced in Baltimore and San Prancieves how an impossibility in Manhattan The area
curred to something over twenty-eight acres with three
levels below the main from, the lowest being 36 feet

alls designated for band for estinguishers. Special provision is made for planthers and at telciums to report at all fives, being subject 1, the indexs of the five marshal, and certain of the elevative lifts are designated for transporting the apparatus who required on upper floors. A unique feature is found in the tunnel adams for transmitting dipads indicating the and for cutting off current to the power with. There are 116 boxes on this action divided into its corollar conductive form of the control of the c

London's New Gasoline-electric Omnibus

How Three Inventions Were Combined to Make an Automobile

By the English Correspondent of the Scientific American

THOUGH the motor bus has practically displaced A the horse-drawn relacie in the streets of London, and the majority of other British cities and towns, perfection has by no means been attained. The general type of vehicle is cumbersome, unveloped and noisy, while its centrol is not all that could be desired, despite the perfection of details. Some two or three years age efforts

vehicle is cumbersome, unwieldy and noisy, while its control is not all that could be desired, despite the perfection of details. Some two or three years ago efforts were made to introduce a combined gasoline motor electric drive with a view to eliminating the drawbacks of the gasoline system, but these experiments were not succeasiful. Now, however, owing to the public outcry against the motor omnibus, the problem has been further investigated, and the Dainier company have evolved a new vehicle, which which has been found eminently satisfactory. The system adopted is that known as the "K. P. I.," from the fact that it is constructed upon the Dainier-Knight, Pie per, and I. an che ster patents. The vehicle and its propelling mechanism contain many ingenious features, the construction itself being carried out upon entirely new lines.

new lines.

Instead of employing a chassis to which the superstructure is attached, the vehicle is

chassis to which the superstructure is attached, the vehicle is
in reality a homogeneous whole,
there being no frame in the accepted sense of the word, this
being abandoned in favor of a
trough vulled from sheet-steel
and extending the full length
and width of body. Channeled
themser are members are rived—
tion, as are also the main members supporting the roof.

The most interesting feature, however, is the design and
construction of the propelling equipment. There are
two distinct power units, consisting of gasoline motors
and electric dynamotors, a secondary battery being held
in reserve. By this arrangement considerable mechanism
is disponsed with, such as change-aped garaing and back
diving wheels. The propelling mechanism is suspended
on brackets attached to the steel trough foundation on
either side, in the space beneath the passengers' seats.

Each driving unit comprises a 13-brare-gower, four-yilader Dalmier-Knight gasoline motor to which is coupled a
shunt-wound six-pole dynamotor rated at 8 kilowatts,
but having a "give and take" capacity three or four times
in access of this rating. The dynamotor is builed to an
extension of the create case and base chamber of the properties
from each sect extends a universally jointer forthy- right.

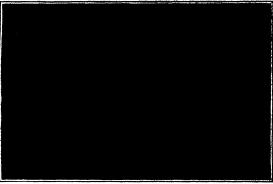
From each sect extends a universally jointed abstr, which
of worm gearing to two short live axies carrying the rear

wheels of the vehicle. By this arrangement the ordinary differential is supplanted by an electric balancing system. The water circulation for cooling the sacoling motives is provided with a radiator carried in the front of the vehicle, to which both engines are connected, the pump being dirren by a small half-horse-power electric motor. Each of the power unit is moreover fitted with a mag-netic title and a burst of the power with the processer of the power with the When the vehicle is running light the drive is by the

By this system the control of the bas simple. In starting up, the accumulate in, the airve being electric. The signasses start up the guarkine engines which take the read wheels, the dynamotors wrettly ing of the eccumulature unless the lond? I storting wheel are monitted two control ages with the throtties of the two gains

The wheels are of large diameter and are of the Radge Whitworth wire type, which are lighter and stronger than the

warworth write type, which as a lighter and stronger than the manufacture of the control of the



One driving unit, showing situation at aids of vehicle.

gesoline motors, the dynamodors acting as dynamose charging the secondary battery, consisting of \$8 cells of the control of th



The dashboard and front wine wheel



London's now middless distribute

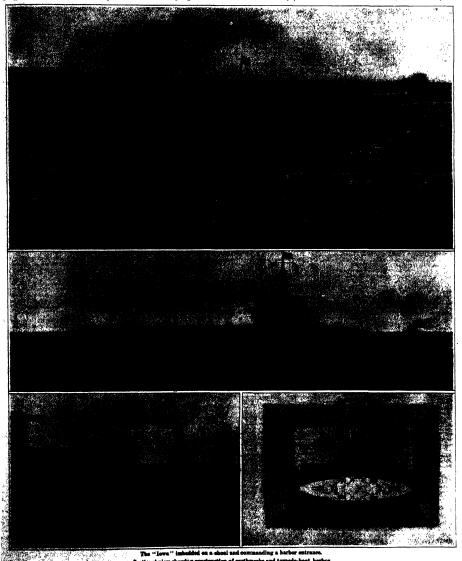
Old Battleships as Permanent Forts

Coast Defenses Versus the Scrap Heap

ATCLESSIIP, coating ten to twelve million dollars, belowing obsolete after seven to ten years of a pan of the twenty years of like, it is, for deep or a particulty useless. The deterioration is chiefly appeal, and somewhat less in the armanent papeal, and somewhat less in the armanent of greaky of the older guas being less than that of makern sutyput of our ordnance factories. The sensetian good for all time. The hall, if properly des against cereation, absuild be available for a long of nacraions. The limitations in speed and in the

range of the guns, soon renders a ship unable to take her place in the first fighting line, and before many years have passed, also is unavailable even for the second line. Then, this investment of from six to twelve million collars is put up for suction and goes to the screep heap. If some duty could be found for the obsolete battleship, in which a ten to fifteen thousand-yard fighting range for the guns was not indispensable, and in which speed was of no account whatever, a vast smount of most valuable fighting material would be saved for military pur-

poses. Now it has been suggested that such a sphere of usefulness can be found for our obsolete luttleiships by emplacing them permanently upon certain shoul grounds at the entrance to our harbors or contiguous to our waterways, and turning them into permanent, fixed, coast fortifications. We present a series of drawings showing how this might be done in the case of such a battleiship, say, as the old "lowa." We can well believe that the up-to-date naval man who thanks in terms of 23-knot, 30,000-ton buttleiships, and



ent, and harbor of refuge for destroyers Plan showing cofferds and mb

OLD RATILIBIEDS AS PERMANENT PORTS

14-inch guns of 12,000 to 14,000 vards effective fighting 14-inch gams of 12,000 to 14,000 years affective fighting range, will look at this presentation with a smile of annu-ed curinost. It is certainly hybrid; but like many another proposed of startling originality, it will be found upon closer and thoughtful attention that the suggestion has a great many valuable features, which should commend it to the carnest consideration of our army and

Briefly stated, some shoal place could be selected at the periorny stated, some since piace could be scacced at the entrance to a harbor, or at some other waterway to be defended, and, by means of double rows of piling, a cofferdam would be driven, of sufficient dimensions to alconferrian would be driven, of antherent dimensions to allow the battleship to be floated within it Previous to its entrance, however, lines of pilling would be driven in the proper position to support the ship along her central and her docking keels. The mud or sand would then be deriveded out, the pilling cut off at the proper height, and the ship would be floated in and allowed to settle upon the bed thus provided. The conferedam would then be clased, and sand or other suitable material would be pumped or theresize filled in around the ship to a point well above the protective deck, or as high as might be deemed expedient. This filling would be continued seaward on the channel sides, for a distance of 50 to 100 feet, finished with an easy along, and rip-rapped on its face deemed expedient. This filling would be continued general on the channel sides, for a distance of 80 to 100 feet, finished with an easy slope, and rip-rapped on its face to protect it against wave action. The coffersian and filling would be extended on the less side to inclose a rectangular basin, which would forms a harbor of refuge for the state of destroyed and admarknes. It should be extended to the state of the s

The earthwork surrounding a battleship fort will render it perfectly secure from any torpedo attack, while, the tube running out from the battleship fort will stable, the fort to fire modern high-powered torpedoes with great accuracy, at any hostile battleship.

Submarine torpedoe best could also be available to re-inforce the battleship fort to render any attack by the county's battleship propeless. The submarine the strength of the desired of the submarine to the submarine to

of the fort.

The battlethip fort is therefore the most formidable type of coast defense fortification; so much so that the existence of an adequate number of such defenses, located at strategic points at the approaches, will probably insure such a port immunity from any attack by a hostile feet.

A battleship fort with propalling machinery and nertgating appliances removed will have in itself supple space
for barrack for a gartino of once two congulates of
coast artillery, quarters for the officers, stererooms,
magasines, and shell rooms, and reservoirs for fresh water
in her double bottom compartments; while all machinery
for operating urrets, ammunities supply, electric light,
power and heat will be retained in the battleship when
intalled as a battleship fort.

All battleships are provided with a ventilating system
that supplies reash sir and exhausts foul air in all compartments of the ship; so that the sanitary conditions
are equal and in many respects superfor to those of any
installed as a fortification.

The Navy Department is joth to give up the older bat-

netabled and a final property of those of any property of the set of any property of the set of the property of the set o

be convert

1, "Alabama"; 6, "Bilicole"; 8, "Indicase"; 8, "Investigation, "Recensary," 5, "Eccurated," 1, "Recensary," 1, "Recensary, 1, "Rec

proved Stummouse un passage,
Similar bettieship forts can be installed at Delaware
Capes, at the entrance to New York, Long Island Sound,
Massochusetts Bay, Puget Sound, Golden Gate, San Francisco, San Diego, Cal, Straits of Fiorida, Honolau,

powerful defense.

The country demands adequate protection not only by having command of the sea but also by having adequate coast defenses at approaches to our sea ports and not within our harbors.

Correspondence

Locating the Pole by Daylight Observations of Venus

To the Editor of the SCHENTIFIC AMERICANI

To the Editor of the SCENEVIRO AMERICAN; STANDING AT the north pole of the earth, the dome of the leavens would appear to be stationary. There would be no rising or setting of stars. During the long polar night of nearly six months the only stars visible would be those lying north to the celestial equator. The horison and the celestial equator would coincide. The splendid stars Sirius, Antares, Rigel, Spica, Fomalhaut and those in the Girdle of Orion would never be seen. Vegain altitude would always remain 38 degrees and 41 minutes above the horizon, and Betelgeuse would remain at 7 degrees and 32 minutes. The moon and the planets would be visible only when they were north of the equator.

and the planets would be visible only when they were north of the equator.

The chief point of this article is to point out that the planet Venus could be used in full daylight to direct the explorer to the pole and to accurately indicate when the pole had been reached. It is perpetual day at the morth pole from March to September, and, of course, the fixed stars are instilled during that period. Therefore, the positions of explorers in the polar regions have been dereuned by soften observations, and the polar than the polar

well north of the equator, she is at times continuously in vives for weeks.

Had Cook been at the north pole on April 21st, 1969, as claimed, he would have been able to see Venas with-out a giass. Venus was at that time approaching her greatest brilliance, which she attained on May 29th. On April 21st, 1908, her altitude above the polar horizon was 38 degrees and 38 minutes, and 4 minutes after the sm. The 38 degrees and 38 minutes, and 4 minutes after the sm. The grees and 49 minutes above the date was my 11 de-grees and 49 minutes above from a caccurate results han observations of the smooth of the following reasons: First.—The smallness of her dock would permit of more accurate observations.

First.—The smallness of he risks would permit of more accurate observations. Second.—On account of her higher a littude refraction would be made hess than in solar observations. Third.—Eye strain due to solar observations would be savided. Double observations of Verms and the sun could also be used as checks on each other. When Verms is south of the clerital squates her could be used in the source manner for determining south polar latitude and in the same manner for determining south polar latitude and in When Percy was at the pole Aprif (8th. 1969, Venus was favgably placed and could be seen. In the current until the Company of the control o

Solar Observatory, in which he says that during one clongation in 1910, "Verons was visible in full daylight to the unsided eyes for 216 days, very nearly a complete sidereal period. . . The only precentions taken at any time were to have the eyes in the shadow of a building, post, or similar object." He found that only four days for inferior conjunction with the sun, the planet became visible in the day time to the naked eye. It will thus be seen the in this latticet Vernus was visible in sunlight during nearly two-thirds of the year 1910. Indianapolis, Ind. Journ Carons Dax.

The New York Motor Boat Sho

TOR the screen types in exhibition of motor books. In engines and accessories was held recently in Mathematica on Square Garden. Of the 182 separate redbliets, if were boat builders, 49 engine manufacturers, and pracessory makers. The engines and accessories filled the greater part of the supple space available in the Garden.

the greater part of the ample space available in the Garden.

Although most of the progress made in the last twifve-month has consisted of refinements in details, there has been a decided classifying of the buils for the various uses for which they are intended. In the cruiser class particularly, the increased use for short smeeday or deck in form, in arrier to obtain the interfreed size of the contract of the case lines and flat after body of the runabout. Fitted with medium-duty engines of the lighter types, these cruisers will frequently make 19 to 50 miles an bour. As for the large cruisers at the show, with the single exception of the "Rilco of Lusee", which was 54 fect over all, the limit of length was 45 fect. Two cruisers of this length were shown, as well as two of 40 feet. All were of the bridge deck type and were fine examples of increased from a maximum length of 66 feet last year to 138 and 140 feet.

**As for several success a serveral excellent reasonables of a contract of the case of launches.

increased from a maximum length of 66 feet last year to 138 and 140 feet.

As for speed launches, several excellent examples of these craft, fitted with comfortable cheirs, were emilished. They are capable of speeds in the vicinity 30 miles an instance of the speeds of the speeds of the speeds of the high property of the speeds of the hydroplane type have shown thousands to be the speediest of all during the past year. The "Pleases," which made the greatest speed in the international greaters from the Harmsworth Trophy last August, was a "Paulous hydroplane, and it is probable that a number of sinther traft will be built to defend the cap this year in the two or more vaces that are now required inspected of the tone.

As for small, light, craft, those were well sequenced of by motor dories and exame. Some of the tithing and lightest motors on ambittion was returned to

coast defenses at approaches to our sea porus and nor within our harbors.

latter craft. Other light yet powerful motors, chiefly of the two-cycle type, were intended for seropianes or racing motor beats. One of these laving sta 5 by 3 cycle to the property of the two-cycle motor of these laving sta 5 by 3 cycle and the season of the season of the season of the season of the beat engines, one two-cycle motor was noted with a rotary valve for admitting the charge to the crank case. This form of valve, which was invented and applied successfully some cight years ago to a 4-cycle double-acting motor of anovel design by Janse W. Tygard, has been adopted of late by a number of automobile-engine makers that the season of the season adopted of late by a number of automobile-engine makers that the season of the season of the season of the season adopted of late by a number of automobile-engine makers that the season of the season adopted of late by a number of automobile-engine makers that of the season of the season adopted of late by a number of automobile-engine makers that of the season adopted of late by a number of automobile-engine makers that of the season of the season adopted of late by a number of automobile-engine makers that of the season of the season and the open and the season of the season of the season, though not as many as heretofore. The majority of the engines were of the light-weight or medium duty size, chiefly of the seycle type. A double-acting motor of this type was one of the features of the show of the season of the season

How Sugar is Tested

Polarized Light and the Saccharimeter

By Joseph B. Baker

The AW augar, as it is delivered to the refiners, is a Rypoduce of reey variable quality and corresponding market value. The quality of a given lot, as it reaches the factory of the refiner or the docks of a port of entry, is not accurately determined by the physical appearance or tasts, but by canning a sample in an optical instruction of the property of rotating the plane of polarization of a beam of polarized light, passed through a column of the solution, to the right or left.

THE PORMER EXPENDED OF VERSIES.

The property of solutions of ordinary commercial angars, of rotating the plane of polarization of a beam of polarized light, passed through a column of the right—the extent of such rotation being determined by the presenting of creating the plane of polarization to the right—the extent of such rotation being determined by the presenting of creating the plane of polarization to the right—the extent of such rotation being determined by the presenting of the duties imposed by the Treasury Department, until 1883. The method of testing that had been in as we ask mown as the Dutch standard method, and was based on a comparison of the color of the sugar undertest, by eye, with the colors of a range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages of sucrose. The range of sugars of known percentages and sucrose of the function of sugars to be tested, and matched its color of the hundred sucrose of the sugars of the sucrose condition of the sugars—more of the sugars of the sucrose condition of centrifuga

tent, and therefore their market value, ingiculty cause for.

Polarization Lists.

When a beam of ordinary light is sefected from the marken of a sheet of glass it becomes "plane polarization." The same thing occurs when the beam of light is allowed to pass through a "Nicol prinari," made from a crystal of Iceland spar. According to the undulatory theory, a ratin of light waves Is propagated through the ether by displacements at right angles to the direction of the beam, and three displacements may be resolved into two components at right angles to each other and to the direction of propagation. In a beam of plane polarized light, one of these two components is asypressed, so that the wave motion in a superficient of plane polarized through the twent emotion in a superficient plane, planed of in all the planes that include that exist.

A Nicol prime used to polarize a beam of light in a polarization apparatus is called a "polarizer." A second Nicol, called an "manlyser," placed in line with the polarized beam, serves to indicate the angular position of the plane or polarization by extinguishing the beam when turned into a certain position about the optic sais of the two Nicols.

of the two Nicola.

THE SACCHABIMETER.

The polariscope is constructed with Nicol priams, and with plates and wedge of quarta which serve to impart right-hand and isft-hand rotation to the beam of polarisal light to coppensate for the rotation due to the substance being tested in the instrument. The form of polariscope employed for testing sugars is called a saccharimeter, and its general construction may be described as follows:

meier, and its general construction may be described as follows:

The associarisative is a horisantal tubular instrument mounted on a stand and direct as indicated in diagrammatic accident in the control of the contr

scale which may be calibrated direct in percentages of sugar value in the solution under test, and which is read by means of a separate eye piece or "reading tuhe" adjacent to the main eye piece of the instrument.

In the actual procedure of teating sugar by the sac-charimeter, the sugar is weighed out and dissolved in about 30 cubic centimeters of water. The solution is then clarified by lead acetate solution, under up to stand-



Fig. 1. -- Section on optical axis. Haensch half-shadow

ard volume, 100 cubic centimeters, in a calibrated flask, and filtered. The observation tube (200 millimeters long, saving seeve expa and glass disks, at each circl, scaled by soft-subber washers) is then filled and put into the sar-charmeter, the illumination regulated, and the reading made. Considerable manipulative care is exercised in stilling the polariscope tube so that the space is just filled without the causing of pressure on the disks when the caps are accessed on. The source of light is preferably an incandancut garment of the control of the co



Fig. 2.—Three appe When compensated for rotation of double quartz (middle figure) and mecompensated (right- and left-hand figures).

field perceived may show as a round, luminous disk divided into two halves by a vertical line passing through the center, one half of the disk being darker than the other. Rotating the milled head connected to the quartz wedges, Rotating the milled head connected to the quarts wedgers, to make a setting of the instrument, changes the appearance of the field, the half bitherto dark becoming lighter and size errae. The wedges are adjusted till both halves of the field appear of the same luminous intensity, at a indicated by the middle figure of the accompanying drawing. Fig. 2. When this equal Illumination has been or reading tube of the instrument (not indicated in the drawing. Fig. 1), through which the setting of the wedges is read, giving the percentage of crystallushle matter, or pure sugar, directly.

The observer at the saccharimeter reads a number of

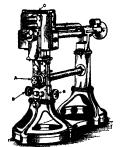


Fig. 1.—The Bates quarts o

THE LATEST FORM OF TESTING INSTRUMENT

tubes in succession; but adjusts the sero of his cour tubes in succession; but adjusts the zero of his compen-nating wedge before making the first test by a thumb nut at the wedges, obtaining his matching of the double-quarts field with no uptically active substance in the instru-ment, but with the availation of the wedges neutralized by the right-hand rotation of a quarts "contral plats." The make proper is attached to the vodge which is moved by the middle fland, and attached to the other vodge is a vernier. On each side of the zero line of the vernier a onding to nine divisions of the movable scale space corresponding to nine divisions of the movable scale is divided into ten equal parts; a device by which the fractional part of a degree of rotation of plane of polari-zation, indicated by the position of the zero line, is ascer-tained in tenths.

THE BATES SACCHARIMPTER

anton, manages by the position of the zero line, is ascertained in tertil. IF ARMS ASCHIABISTES.

The saccharimeter or "quarts compensating polariscopewith adjustable sensibility" of Dr Ferefeirick Bates of the Government Bureau of Standards' is an improved instrument which has been adopted by the United States government for the combination of sugar at the various ports of entry, and by the Department of Agriculture. This instrument (Fig. 3) is the first wedge-compensation polariscope for white light baving sensibility and brightness adjustable, thereby allowing plenty of light to he used to facilitate the reading of very dark solutions and at the same time allowing an accuracy of 0.01 per cent in testing the letter grades of sugars; there being and at the same time allowing an accuracy of 0.01 per cent in testing the letter grades of sugars; there being and at the same time allowing an accuracy of 0.01 per cent in testing the letter grades of sugars; there being an letter of the same of the same of the same polarization place of the analysing Nicol at right naging system, in which the polarizing angle is formed by two beams of plane polarized light coming from two separate Nicols, one of which covers but half the aperture of a larger Nicol. The adjustable sensibility feature is attained by a simple mechanism which acts to maintain the polarization plane of the analysing Nicol at right angles to the plane bloecting the polarization angle (commonly denoted by a), i. e., the anglysing Nicol and the large Nicol of the polarizing vateus are mounted in bearings and driven by gears from a common connecting-road, by turning a milled head, A, fast on this connecting-road, to rotate the two Nicols, the analyzing Nicol always receives one-half the augular displacement of the large Nicol of the polaring system, are mounted in bearings and driven by gears from a common connecting-road, by turning a milled head, A, fast on this connecting-road, to rotate the two Nicols, the analyzing Nicol always receives one-half the augu shows the polarizing angle for any position of the

ing against displacements of the age is even of our persisting system. A round the milled head is a circular scale ing system. A round the milled head is a circular scale solution of the Nicols.

Other features of improvement in the instrument are the location of the milled heads which move the quartz sedges of the compensator in a position (R, in the illustration) which permits the arm of the observer to rest free while making a setting. The wedges can be clumped rigid, instantly, at any part of the scale. The scales on the quartz wedges are of ground glass, and are read by transmitted light so that the scale divisions are very clear and there is no laked dividing line thewers a social of the control of the metal bux containing the compensator. The tube of this thermometer is horizontal, but its bulb is placed between the two wedges so that a reading for making correction for temperature of the wedges is readily obtained. Another unior improvement is in making the base of the instrument heavy and mounting it on rubber the. The restituting hertin of the instrument and friction on its supporting bench preventing accidental shifting with reference to the light source, and the control of th

rain amorances or natural origin from amosances must synthetically to compete with them in price. An example is methyl salicylate, which when synthetically prepared has the characteristic odor and the identical chemical composition of oil of wintergreen.

A Laboratory of Therapeutical Chemistry

A Laboratory of Interspettites Circumstry
IT has been decided to install a laboratory at the
Pasteur Institute at Paris to be devoted to research in
therapeutical chemistry. It will be under the direction of
Prof. E. Fourneau, a scientist of considerable note, who
has been occupied with experimental work for a number
of years past. His discovery of stonding in 1904, which
is a local amentable to great value, attracted much at-

* Described in reprint No. 36 of Bulletin of the Bureau of Standards, vol. 4, No. 3, 1895.

Recent Aeronautic Progress

A New German Airship and the Voisin Military Biplane

A Huge Non-rigid Airship

A Huge Non-rigid Airship

A N airship has just been completed and tested, which, Acqualing the Zeppelins in size and general arrangement, is bult without any sittlening frame. All the weight thus saved is put into additional propelling power, and as the airship has very nearly as slight a drog from its rigging as a rigid Zeppelin, and a total of 500 horse-power as against 100 of the "Zeppelin", it should show phenomenal speed. Its large size—130 meters (38x7. feet) length, 13 meters (48x6.5 feet) beam, and 13,500 cubic meters (478,799 cubic feet) displacement—maker necessary a slender-shaped envelope (like that increasery a slender-shaped envelope (like that increasery a slender-shaped envelope cubic heat are static pressure of the gas against the back of the envelope, due to the greater "head" of gas that results from a larger beam, acts like a stiffening backbone. The "Krell I" is heat described as a "non-rigid Zeppelin." She takes her name from her designer, the director of the Siemens-Schuckert works in Berlin. The ship was building for two years and the envelope had at one time to be completely reconstructed after weakness had developed much strength a Zeppelin derfees from the mery constructed after weakness had developed much strength a Zeppelin derfees from the mery ressure of the gas—quite apart from the rigidity of its frame. There is the same long passageway of triangular cross-section rounning almost the whole length of the ship in under the high and the control of the ship is cutive length. The footing. Yet it feels hardly less solid, and not only provides communication between the the footing. Yet it feels hardly less solid, and not only provides communication between the lead over the ships in other heads of the footing. Yet it feels have been been been and the case has been gained to carry two motors in the front are as a carry only in that the "captains bridge" has been moved from the front are as a carry only in that the "captains bridge" has been moved from the front are as a carry only in th and this space has been gained to early two motors in the front car as well as in the react of the cars and not on the facilities of the cars and not on the facilities must be care and not on the facilities of the cars and not on the facilities of the cars and not on the facilities of the cars and not on the facilities of the cars, one 125-barse-power motor drives two two-bladed propellers, mounted on outriggers on the side, and the other motor of the same power drives one four-bladed screen mounted directly on the clongeted motor shaft motor of the care the care

cially as the center car is—also following Zeppelin's practice—raised to the level of the outer ones.

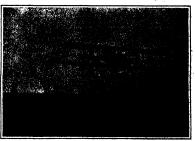
In a flexible airship of such size the airblowing blowers for maintaining the air pressure in the ballonettes are quite large. The center car has been set apart for these, and there are two motors, each of 25 horse-power, to drive them. One motor only is used, the other remaining in reserve. The cars are only after the control of the property of of the proper

The Military Voisin Biplane

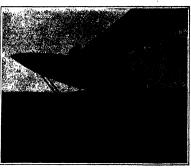
THE Voisin Brothers have lately brought out a new light-weight biplane intended primarily for military use, in which the front borisontal rudder, or elevator, has licen dispensed with, and the seats for two men have been located side by side in the covered forwardly-projecting body that has been used on all Volsin machines.



The new "Kreil L" airship of the Siemens-Schuckert non-rigid type



Marchal flying with hands off the control wheel.



Side view of prow, showing duplicate control wheels.

A NEW AIRSHIP AND A FRENCH BIPLANE

A NEW ALESCHIT AND A FRENTURE NEW SERVICE AND A TREATMENT AND A TRAATMENT AND

or assembling of the machine. This inding is dispitated or assembling of the machine. This inding is dispitated in shape, which gives the minimum air resistance. The aeroplane is measured on two passements-time directly and the state of the control of the contr

single vertical rudder, while by pushing pedals, they can pull down on the allerons, or inleged flaps, in case the machine tips to one aide or the other. On the control of the pull of the other of the respective to the control of the pull of the control of the control of the pull of the pul

siderably greater than this. On account of its considerable weight-carrying ability, this new Volsin hiplane can be used for bomb dropping, or for the carrying of passengers. The moving of the center of gravity of the machine so far forward has taken practically all weight off the tall. As a consequence this is practically flat and set, if anything, at a negative angle when the machine is in flight.

The set of the tall is a consequence the practically flat and set, if anything, at a negative angle when the machine is in flight.

But the consequence of the consequence of the tall is a consequence this is practically flat and set, if anything, at a negative machine is a flight of the consequence of the conse

EARANK PAINE, a chaffest who has recently a Cartias-type hiphase and made a number of algebra at Mincola, while practicing at Bridgeport for an exhibition flight, not with a western sold March 8rd. Be was flying of feasible Park, showed of Long Island South, and affect pasking at the flower of Long Island South, and affect pasking at the first of the flight of shoot half a mile of a beginning of the sold of the control of the sold of

The Heavens in March

Our Monthly Astronomical Page

By Henry Norris Russell, Ph.D.



RE problems with which modern astronomy has to deal are as varied as the heavenly bodies. For the last two months we have discussed recent advances in the knowledge of certain stellar systems. At this time it may be of interest to turn to quite a different problem, that of the origin of comets, of which a very interesting discussion has recently been given by Prof. The point at lessue is not the comets members of our solar systems and returns to the sun at definite intervals, obviously belong to the former class. But for the majority of comets the situation is less bovious. It must be remembered that a comet may move in any one of three kinds of orbits and instruction of the comets and present of the comets and the comets of the situation is less bovious. It must be remembered that a comet may move in any one of three kinds of orbits and instructions and marrow, but closed and returning to the sun; a parabole, whose branches diverge or records, become ever more nearly present or a hyperbola, whose branches diverge even more widely, like two lines drawn in different directions. In the first case the counct will return to the

drawn in different direc-tions. In the first case the conset will return to the sun; in the others it will never do so. The second or parabolic form of orbit is a transition between the other two. Now, most consets move

between the other two. Now, most comets move in orbits very near this transitional form, so that long and accurate series of observations, and careful calculations, are necessary to construct the same series of observations, and careful calculations, are necessary to the same series of the same sa

accelerated, it will peas off in a hyperbolic path, never to return.

Of the comets whose orbits have been accurately calculated, the majority move in long ellipses, but a few in orbits distinctly move in long ellipses, but a few in orbits distinctly are in orbits distinctly as few in orbits distinctly are in orbits distinctly as the constant of the majority of the constant of the motion of counts whose path would observe he have been elliptical? It might seem as if the fact that the majority of the counts observed move in ellipses, aboved that such orbits readly preforminate; but this angleste the circumstant of the counts observed move in ellipses, aboved that such orbits readly preforminate; but this angleste the circumstant of the counts of the count

standpoint, obviously belong to the sun's domain.

The apparently exceptional cases are those when we observe a come in process of tools to the system to which it previously belonged, fleeing sway into space by a comparey of plantary and solar attractions, and lost to us forever. There is, of course, some small chance that such a comet may pass near some other system, and he captured there, and also that one system should pick up some such outcast from another family; but the interplanetary spaces are so small, in comparison with the vaster void which surrounds them, that it is no wonder that no such visitor has passed within our range in the few centuries during which the heavens have been studied well enough to enable us to distinguish it if it came.

Turning to our map, we find the twins Castor and Pollux almost overhead. To the west and southwest are the familiar forms of Taurus, Orion and Canis Major.

of the pole, and Cepheus and Cassiopela on the left, Andromeda and Aries are acting in the northwest and west with Perseus above them, and Aurega still higher. Saturn, very low in the west, is the only planet visible to the unaided eye.

THE PLANETS.

Mercury is morning star until the 30th, and evening star afterward. He may perhaps be seen in the twilight during the first few days of the month, but later will

e invisible.

Venus is splendid as the evening star, and is increasgly conspicuous, setting at 7:98 on the 1st, but not till
is5 on the 31st.

Mars is morning star in Capricornus, rising about \$

A. M. on the 18th.
Jupiter is in Libra, and rises at 11 P. M. on the 1st
and 9 P. M. on the 3lst. On the 97th he is a little over
1 deg. north of the wide double star Alpha Librae,
for a field glass, or better,
a small telescope. Saturn is

for a field glass, or nector, a small telescope. Saturn is evening star in Aries, set-ting at about 10 P. M. at the beginning of the month, and 8 15 P. M. at the close. He i. in conjunction with is in conjunction with Venus on the 29th, not very

Close by.

Uranus is morning star.
On the 11th he is in conjunction with Mars, being 24 min. north of him. If

junction with Mars, being 24 min. north of him. If the planets were only visible at a convenient hour of the night, this would be a very good line to find the fainter of the two.

Neptune is mine to find the fainter of the two.

Neptune is mine to find the fainter of the two.

Neptune is mine to find the fainter of the two.

The moon is in her first quarter at 6 P. M on the 7th full at 7 P. M on the 14th, in her last quarter at the same hour on the 24d, and new at 7 A. M. on the 30th She is nearest us on the 6th, and farthest away on the 9th, and farthest away on the 9th. In her circuit of the heavens she passes Venus on the 9th, Neptune on the 10th, Jupiter on the 10th, Alpanet on the 2th, Uranus on the 3th, and Mercury on the 8th.

At I P. M. on the 21st, the sun crosses the celestial equator, passing through the vernal equinox, and, in the language of the almanaca,

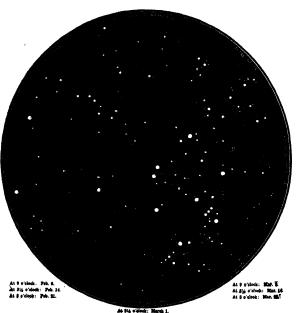
Current Supplement

I N an article entitled

"Cellulose," which opens
the current Superaments,
No. 1836, Mr. Carl G.
Schwalbe discusses one of
the most misunderstood sub-

Schwalbe discusses one of the most misunderstood substances in the world, and gives a vast amount of information of a most interesting kind-Prank C. Perkins contributes an illustrated article on modern German police call and fire alarm systems.—If the manufacturer has any doubt of the value of illuminating engineering to him, be has but to read an article on that subject by Mr. V. R. Lisangh.—A remarkable Spanish mining concrete pier is described and illustrated.—Mr. George J. Jones writes in the state of t

A CCORDING to a recent press dispatch, the whre-faces talagraph station at the Biffel Tower is nearing completion, and it is hoped that direct communication can be established by this means between Paris and New York and Canada. Already messages have been trans-mitted from Paris to Tunis and other points in Africa.



NIGHT SKY: FERRUARY AND MARCH

NIGHT SET. FERRIARY AND MARCH
Far in the south, only partly above our horizon, is the vast
southern constallation Area, whe skip which hore Jason
and his comrades on one of the most romantic adventures
of classical story, This constellation, as unfavorably
placed for our study, is the largest in the heaven, containing 133 shaw sighile to the naked eye (Draco following with 99). Indeed, it is so big that, to facilitate
reference to stars within it, it has been divided into three
parts—Puppis, the stem; Carina, the keel, and Vela, the
salis; whose relative positions may be seen in nor
initial. Huge as it is, it represents but half the shiptitle prove being middle. General the seen in the provention of the control of the control
provential three control of the control
provential three controls and the Southern Cross.

Its brightest star, Canopus, lies but 37½ deg, from the
south pole of the heavens, and its greatest altitude (in
degrees) above the southern known, may be found by
subtracting the observer's latitude from this number. It
is hardly visible at all in Virginia, and can be neen well
clear of the horizon only in the States bordering on the
Gulf or on our seathern boundary. There can be no difficulty about identifying it as it is second only to Sirius,
and twice as bright as any other star in the heavens. It
is almost the south of Sirius, and can be the neen about
half an hour before the latter crosser the maint in the
mental property of the property of the conparting. Leo is well up in the east, Bootes is on the northeastern horizon, and between the two is the diffuse starciaster of Revenievic Histr. The Great Bear is high in
the neytheast. Draco and Urps are

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

Nehulae

NEBULAE play a prominent part in modern theories

Nebulae

Neb

of the nearest stars, its mass must be very small Hence the mat-ter which composes the nebula must be very nebula must be very much less dense than that of any "vacuum" that can be produced in the physical labora-

How worlds are built of such exceed-ingly attenuated matter

ingly attenuited matter remains and reduced in ingly attenuited matter remains and reduced in the includer light. In those nebuler that show continuous spectra, like those of the stars, the process of development is more easily comprehended. To this class belong the nebula in hardrameda, the most atriking in appearance of all nebulae. According to Prof. Bitchey, the spiral nebulae contain great numbers of star-like contemptations, or nebulous stars, which are possibly stars in process of formation. These are hiermingled with streams and patches of nebular matter.

Kerler, who devoted especial attention to this subject, estimated the number of spiral nebulae at several bundered thousands. These nebulae exhibit the initial stage of forgation of new worlds on a stuperdous scale, and have themselves here produced by the destruction of former suns. Prof. Chamberlin explains their spiral

structure by the oblique collision of two stars, canaling the violent cruption of two streams of matter which assume a spiral form in consequence of the rotation and attraction of the colliding and coalescing masses. Some spiral include distinctly above these two streams. For the pressit, however, all theories at the most general form of the contract of the contra

A Substitute for the Monocle

THE moncle is a venerable institution. The use of appetacles did not become common until near the close of the fifteenth century, but throughout that century a reading lens provided with a long handle was used



The monocle and the monocular pince-neg.

very generally by elderly persons. This implement was called, at first, a manocie (hand eye-gikas), afterward a monocie (single eye-gikas). Long after this period ornamental monocies of this type were earried, like the modern double largestet, by laddes and gentlemen of fashion, and employed chiefly to emphasize a haughty store, and have been appropriately re-spipared as substitutes for double largester.

lifey into the control of wearing a monocle held in place by the muscles surrounding the eye is of uncertain origin. Dr. Oppenheimer, whose discussion of the subject in Dis Umerhous forms the basis of this strick, concludes that Unriches forms the basis of this article, concludes that the custom is not many generations old. The ridleyde which was cast upon the weaters of spectacles and gregiases, before the utility and need of those adds o sight became generally recognized, seems now to be concentrated upon the monocle, and not without reason. The conclusive facial distortion and peculiar appearance of the eye caused by the monocle (Fig. I. left), and expectally the fact that it is used only by members of the "higher classes," and often, orbinously, through other fop-



A beach which has lost the leaves from the ends of the shoots.

Longitudinal section of a stem and base of a leaf stalk of herse chestnut.



The terminal leaves still remaining on a THE CAUSE OF FALLING LEAVES

pery, have brought the monocle into discredit with the general public.

This result, Dr. Oppenheimer thinks, is greatly to be deplored, for the monocle possesses certain advantages over other eye-plasses and spectheles. Theoretically, for-deed, the monocle is the ideal eye-plass, and, if it were possible to wear a monocle in each eye, spectacles and eye-plasses type would be superfusious. The simple monocle costs little, needs no repairs, and, if properly fitted to the eye, is easily kept in the correct position.

The possible paralleles.

position.

The possible applications of the menacle ask since numerous than is commonly supposed. For maniple, a person who for any reason is compelled to seek a bond-

age over one eye usually finds it tillicult at impossible to are a processel or double eye-glasses, but a immossible can be worn without difficulty, so that the issislayered eye and be used in reaching and writing. Again, there are excessed of imported vision which are greatly benefited by some and a committed with a second district and a state of imported vision which are greatly benefited by some proportion of humanity is one-eyed in the sense of possessing only one good eye) usually find aposseches more convenient than specializes or double eye-glasses, as the second glass is only an annoyance. Most, though not all, of the devastages of the simple measured are possessed, while its defects are avoided, by the mosecular pince-saw, while its defects are avoided, by the mosecular pince-saw, while its defects are avoided, by the mosecular pince-saw, while its along its ordinary constructed that if will hold the single glass security in place without the balancing action of the other glass. The American frame, in which the nose is clamped between two plates of metal or hour pressed against its aldes, is the most suitable type. A mesocular pince-saw is illustrated at the bottom of Fig. 3. Its use requires no practice, and producers no distortion and very little change in the far producers no distortion and very little change in the far producers for the face, as is evident from the right-hand illustration of Fig. 1.

How and Why Do Leaves Fall?

THE causes of the autumnal lenf-full are discussed in I an interesting review of the present status of this problem of botanical science published in a recent num-ber of Kaowiedge by G. S. Boulger. The author says,

problem of botanical science published in a recent number of Kaeweldege by G. S. Boulger. The author says, in part:
If we look at the question of leaf-fall from the point of view of the systematic botanist, we find that the lower and simpler types of leaves do not fall. The primitive and simpler types of leaves do not fall. The primitive and simpler types of leaves do not fall. The primitive stands of the system of a simple system of a simple system of the system of the system of a still show the system of the system of a still show the system of the system of a still show the system of the system of

tissue external to this corky layer, from without inwards.

"The provision for the separation," he writes, "being
one complete, it requires little to effect it; a desiccution
of one after of the feet stalls, by causing an effort of
of the feet stalls, by causing an effort of
of the country of the country of the country of the country of the fiber-waxular hundles; or the increased also of the
coming leaf bud will anap them; or, if these causes are
not in operation, a gust of wind, a heavy alwayer, or
even the simple weight
of the lamins, will be
enough to disrupt the
fall of the leaf. We
have found that it is
not an accidental occurrence, arising simply
from the violatitudes
of temperature and the
like, but a regular and
vital process, which

ilie, but a regular and vital process, which commences with the first formation of the organ, and is completed only when that is no longer useful; and we cannot help similar to the wonderful processes chestuat, when the bealt the vision that bealt the cannot help similar to the wonderful processes chestuat, when the control of the con



frein atmospheric changes before the part jected to them."
In 1809 'Huge von Mohl, the illustrious for cell theory, chanced to spend his autumn, higgs, so that he observed the successive fall lets and the heaf stalk in the longuistions of the description of th and the hef stalk in the leguninous Symmodis makeness with the coverentiates of, the delocatory and. He found, that a layer of such almostly such mugh the cellular tissue at the base of the patient parallel maken. Immediately above this a layer of cells is greatly as the contract of th

des each seal the 12th of Bedeler, extending across the state from; the later or sufficient surface, and contained to the cells present the from the form of the property of the form of t

Burse or seeks and the control of the successive fall of the sabetals layers one must have noticed the successive fall of the leaftest and the leaf stalls in the sah or horse chestnut, the thinker of the leaf stalls in the sah or horse chestnut, the thinker of the leaf stalls in the same of the leaf stalls in the same of the leaf stalls in the leaf stall which is, perhaps hose of hinds. There is, however, another interesting little point in connection with leaf fall which is, perhaps fault in the fall which is, perhaps fall the fall which he point in connection with leaf fall which is, perhaps the fall which he leaves fall from the twig. In the beach this basiquests, i. e., the younger leaves at the apex of the twigs fall first. In the linden, the poplar, and apparently in the majority of trees the fall takes place corposatily, i. e., the older leaves at the base of the twigs fall first.

The Universe a Mechanism

A DE UNIVERSE A SIGCHARIAM

THE point or few defined in Herbert Spencer's wellknown "formular forms the starting point and leafing thought of an article published by John Cander Dean
in Popular Astronomy. We have selected for quotation
from this paper a number of passages which seem to be of
special interests.

from this paper a remainder of the process of the process consists in change from the homogeneous to the heterogeneous, and the law of organic progress is the law of all progress. It makes no difference whether we examine into the development of society, povernment, commerce, language, literature, art or the addresal heavens, the same whoulton of the simple into the complex through successive modifications will be accessed through successive modifications will be a complex through successive modifications will be

the complex through successive modifications will be found.

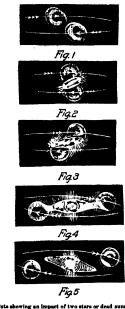
"It is now generally admitted by the informed that all forms of living organisms, including man, have been evident from primative forms of life in which there was no break in the continuity of the process. The orderly precesses is life, and the structure of a minute and plants are derecipied by mechanical laws, and these powerful structures that the continuity of laws, and the powerful the process of the process. The process of the process of property continuity of the process of the process of property of the process of the process of property of the process of the process of the process of property of the process of the proce

changes in its brightness is found in a binary system in which a dark body usadler than Algol revolves around it in an orbit lying edgewise to us, so that at each revolution Algol is spartially eclipsed by the dark star. The discovery of a large number of short period variable stars of the Algol in the star of the Algol is series as a series of the Algol of the star of the Algol of the Alg and are like clocks that have run down

oead Suus that have lost their heat energy by radiation and are like clocks that have run down.

"There is evidence that there is a regenerative influence at work in the creation of new nebuile by the accidental collision of stars. This appears to be Nature's method of preventing the final dissipation of rency which would note that the product cooling of hot bodies and more than the product cooling of hot bodies and more than the star of the product of the bodies and contemporature. Stellar impact differentiates the temperatures of stars, and thereby prevents all matter from a taking the same thermal level. The mighty mechinery of the cosmos is immortal in its workings. Systems are colved, play their pu is on the great stage of the universe, are scattered are a time, only to response in now and equally glorous forms. Censeless change is the only constant thing in nature. The complete cycle of changes carries matter through all its phases, from the simplicity of matter in the hottest nebule up to the composity of matter in the hottest nebule up to the complexity of matter in the planets and in the common Earth.

"When a star suddenly blases forth in a place where



Cuts showing an impact of two stars or dead suns which results in the formation of a temporary star that expands into a nebult.

—Pair of stars distorted by mutual attraction and coming luto-act. Fig 2.—Pair of stars in impact. Fig 3.—Passing out of past and forming a third basis, Fig. 4.—Starteglowers of mad-temperature is formed, which finally expands into a nebula, brawing by Bickerton.

none had been observed before, the phenomenon is supnone had been observed before, the phenomenon is supposed to be the result of a collision between celestial
bodies, which may be either bright stars, black stars, or
meteoric swarms. There are records of more than twenty
new flaming stars, some of which were visible in the daytime. In November, 1978, Tybe observed a star, called
the Pilgrim, that auddenly appeared in the constellation
of Cassiopels, and at once became so britliant that it
could be seen at noonday. Such stars are called Nosa.
Two notable examples of them within record to the could be seen at noonday. Such stars are called Nosa.
Two notable examples of them within record to the could be seen at noonday. Such stars are called Nosa.
Two notable examples of them within record to the collision of the property of the collision of the collision of the collision of the collision.
The latter was the most brilliant new star that has appeared
since 1604. In three days if increased in brightness \$8,300
fold, and for a few hours was nearly as bright as
Stirus. The writer had the pleasure of observing it when
near its most brilliant phase.
"All nova are temporary, and rapidly fade in nebulas. Nova Perset, following the usual course, became invisible to the asked eye in a six weeks, and its spectrum
soon became nebulae. So beriffe was the heat evolved
that the gases expanded outward with a velocity of over
\$5,000 miles a second. Its distance was as great that its
light, travelling with a velocity of field on 50 dece a second.
"All visible fixed stars are gaseous suns, and the full-

ing together by gravitation into direct impact of two auch bodies would probably evolve insufficient heat to produce a nebula, unless the stars originally had conner to produce a nebula, unless the stars originally had conner to produce a nebula, unless the stars originally had conner to produce and the produce of the product and original to a gascous nebula, while the two scarred stars would continue their courses at reduced velocities. Thus partial impact generally results in the birth of a third body of nebulous matter struck off from the meeting stars, and this never star with its momentum destroyed remains behind If the amount sheared off equal mass would continue the mass, then three bodies of equal mass would continue the mass, then three bodies of equal mass would cond to the mass, then the bodies of equal mass would cond out of the mass that may at the star of 100 miles a second would produce a temperature 100,000 degrees, depending to a certain extent on the elements contained in the colliding, bodies. The runaway star shown as 1800 Groombridge, has a motion of about two hundred miles a second.

"It can be shown that stars may explode by near approach, when the traditional experience in the star of the star proach without a structure approach," and the limit of the distance that the two bodies must approach in order to produce disaster is called the 'Roch Limit'. Spiral nebulae are supposed to the result of the near passage of two stars and the one containing nuclei at irregular points. Prof. maller bodies in a substitution of the star that the disruption of a body like the Earth by near approach, where the interior temperature is much above the melting point and greatly compressed with high self-gravity, would cause it to burst forth in a hunimous body with perhaps dispersive violence. Prof. Chamberlia further shows how the meeting point and greatly compressed with high self-gravity, such collision. He also calls attention to the fact that the disruption of a body like the Earth by near approach, whe

TO THE STATE OF TH

of the planetury system the most powerful belescope would only reveal the central sun as a fixed star, the planets being too small, and their reflected light too weak to be

"Either waves were sent out by the Marconi system to carry messages over the sea. Ether waves sent out by the stars bring messages to every part of the world. The stellar reserving instrument employed is called the spectroscope. The wit of man has never devided a more wonderful instrument that this receiver. The messages are not not not not be the spectroscope in the property of the spectroscope in the spectroscope of the spectroscope has been trained on a distant star, what information does the wiceless message convey to the skilled spectroscopist? It informs him as to whether the star is single or double. If double, and the two stars are physically connected, it discloses their velocity of motion in line of sight, and tells the period or mention of gravity; and affords information as to the mutual distance and masses of the components. If the star is single and its motion rapid the message tells whether it is approaching or receding from us and reveals its radial velocity in miles per second. It tells its chemical composition and gives the elements as accuracily as could be determined from a sample of the star in the star is a star and impairs information as to many other things that cannot be entered into here.

"In ducusaing the cullision of stars it was stated that the resultant temperature from impact might reach 100.000 dg P. The highest temperature status and the contractive of the star and impairs information as to many other things that cannot be entered into here.

"In ducusaing the cullision of stars it was stated that the resultant temperature from impact might reach 100.000 dg P. The highest temperature shall see the entered the star and impairs information as to many other things that cannot be entered into here.

"In decusaing the cullision of stars it was stated that the resultant temperature from impact might reach 100.000 dg P. The highest temperature when the stars in the certain of the stars in the contract of the chemist had dreamed. The fundamental mystery of chemistry, shylass and electr

sists in the case-up.

geneous and that the law of inorganic progress to upof sail progress.

"When matter is in its hottest state it is at its
lowest point in the scale of crolution, and all progress
depends on a fall of temperature by radiation. Bickerton's and Chamberlin's theory of the enormous heat
generated by stellar impact agrees with the speal to
Lockyr's percroscopic study of the temperature of stars.
Lockyr's inorganic evolution, jointed to the spiral neblar hypothesis, and this to geological and bisingical evolution, complete the evolutionary cycle of the Earth to its
recent stage.

"Organic life is possible only between the recently said boiling pelast. News a homographus of 16 degrees is destructive to the life of everything enempt the seeds and appress of a few maleracepic organization is paired in the constructive to the life of everything enempt the seeds and the constructive the construction of the constructive of th

The Discovery of the New Element Celtium

The Discovery of the New Element Celtium. We already have noted that Prof. G. Urbaia, of the Parts University, successed in separating a new hole Celtium. According to the account of his vesscrices which he presents to the Académie des Sciences, the greater part of the rare earths which were the object of his work during recent years came from treatment of large quantities of zenotime mineral. In the ytterbann extracted from such earth he found a new element which he called interlum. However, he was obligate to discontinuous control of the called interlum. However, he was obligate to discontinuous control of the control of the called interlum. However, he was obligate to discontinuous control of the co

Van't Hoff's Researches and Their Influence on Modern Chemistry

Van't Hoff's Researches and Their Influence on Modern Chemistry

In the death of Prof. van't Hoff, modern chemistry has I not one of its greatest exponents. A new era in chemistry was inaugurated twenty-few years ago by the publication of Jacobas wan't Hoff's investigation of the laws of the control of carbon, and dismital release had been expressed by Rossitielli a little earlier, and by Pacture in 1861. We have not yet reached the beginning of the chain, for Prof. of which is the control of the

The state of the second of the state of the

accomplished without the intervention of enterest energy tends to produce these substances which netter, the greatest ent quantity of best in their foresation. Both Thomset and Berthalot ultimately abandoned these principles, which had guided their labors for many years. In these two easays of varil Hoff it was shown, furthermore, that the electrometre force of a reversible galactic than the electrometre force of the electrometre force forc

cunnicly in electrical and mechanical units was thus indicated.

Profier's camotic researches had interested only students of regetable physiology, as they had not furnished any simple relation connecting the careotic presence, concentration and temperature of a solution. This want was supplied by wart Hoff's "Laws of chemical equilibrium," in which the laws of rareaded gases, which laws in minortalized the names of Boyle, Gay-Lussac, and Avegadre, were shown to apply also to dishet solutions. A vessel to deep the property of the constant of Hugo de Vries.

A vest field of research was thus opened, and Rasself's empirical laws of solutions were connected and explained. Considerable deviations from van't Hoff's shupple laws were soon discovered, but they were explained by the theory of electrolytic disactions of Svane Arrhenius. Soon afterward, the seat of the electromotive force of the galvanic cell, which had cluded search during a centary, was found by Nernat, with the sid of the new theories, which have since exercised a personal network of the control of the search of the control of the profound induces on the control of the search. The criticisms which have showed largely by overhooding the fact that they apply only to dilute solution.

The Queer Things that Men Est

The Queer Things that Men Est

THE primitive races of mankind est many things that
I seem strange and repulsive to us, though not more so
than some of our favorite dainties appears to them. The
dict of these children of nature will be well illustrated at
the Dresden Hygiene Exhibition, the circular of which,
Hygisio, gives the following interesting details:
At the end of the rainy season the Bushesn of South
Africa go foreging, taking with them their wives and ellifrom and most of their surelly possessions. The man
to be harmless when taken into the stouach. (The South
American Indians claim that the curare which they use
for this purpose makes the feels of the game more digestible) While the men hunt, the women dig edible roots
with sharpened sticks. The favorite root or taber, called
lemba, is as big as a coccannat, like which it is filled with
a mility inten, so that it appeases both hunger and thirst.
Caterpillars are collected, killed by crushing their beads
and carefully packed in grass for future sace. Good
variations are collected, killed by crushing their beads
and carefully packed in grass for future sace. Good
variations after the superdictionary, and is bottled in
attacking sidns for transpersion for many protests
and standard standard for transpersion to the part of the part of the
lateral part of the standard of the first root, and
a grate of learning seeds. The affinial food of the
Australians includes ants, caterpillars, cicadas and inany
other insects. A favorite dish, called tuinshe, is composed of page cases. The level-like covertage which the
actives and their own servettons we diligently collected
and forms a dailty which resembles mans and is called
parally. A filther delicenf is the field of makes width,
with the exception of the liver, is to ody and testeless to
appeal to ctrillend palates. Meet is usually baked in a
primitive over, made by diageing a bake shoet a foot deep
in the ground. In the hole is built a fire which is covered with stower, made by diageing a besteen to a fo

A New Kind of lee Cream

A New Kind of Iso Creams

Printy Isora, Experiment dustion has famed

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se Optical Experiments With Liquids off, Gustave Michaud, Costa Rica State College

Romes Optional Experiments With Liquids By Freel Genderow Michand, Costa Bies Bate College MONG the few liquids which we commonly see or A even showing the numerous liquids which are commonly used by the disensat there is none which has so high a refractive set dispersive fades, as carbon distribution. This is a substant of the second state of the results of the second state of the results of some previous dispersive fades, as a carbon distribution. This is a substantial point of the production of some pretty optical effects, the only needed apparatus being a small apherical glass flast and a larger vessel, square-abaped with parallel, plane addes, as shown on the accompanying figure. A preserve lay, of such shape, selected among those which have the planer and most transparent sides, will do. Haff of it is filled with carbon dissiphide faver combustible and its vapor, when nined with aft, is expolered; it is a dangerous substance which should be handled with the utmost care), and the production of rainbow, which testify to the high dispersive power of the liquid, is immediately, noticed. The little roads disabilities. It is appearance has now completely and filled with water. In carbon dissiphide it is a submerged in the carbon disalphide. It appearance has now completely and filled with water. In carbon dissiphide it is a submerged of in carbon disalphide is comparable to a globe filled with and submerged in water. In both cases the spherical, less refringent medium occupies the center of the large, parallelophyled resuel and is surrounded by the more refringent medium. The rays are in both cases refracted in similar directions and give similar impressions.

cases refrected in similar directions and give similar impressions.

The carbon disalphide is now poured off-tiff the jar and common kerosene is poured in instead, A cold piece of clean, white, polithed plans is submerged in it and the vessel is placed between the eye and a vertical sheet of white paper. Carbon disulphide is now added little by liftle to the kerosene, and after every such addition the liquids are thoroughly mixed and the qitess is examined. It seems to fade away gradually until comes a moment carbon disulphide will then bring it back to sight, but this time with a changed, hollow appearance.

Kerosene has a smaller refractive index than that of crown glass, while that of earbon disalphide is much higher. The moment in which the glass is the least per-ceptible coincides with a refractive index of the mixture which dosely approximates that of glass. Light passes



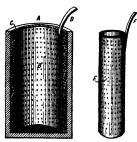
After ball appearance of thipty flask in carbon

then from the liquid to the glass about as if the latter were not then.

For the pretthest optical experiment which can be made with carbon discussed and the control of th the production of the ring a small of the production of the produc Methyl loddoswhas a higher refractive index (1.74) than carbon distribuide (1.84) but its price (80 cents an ounce) is almost probabilities, a arbon distribuide costs but 30 cents a named.

Warning: News allowing fire nor any heated object to be brought allowing for nor any heated object to be brought allowing the vicinity of a vessel containing carbon disruphide.

A Home-made Storage Battery
By A. J. Jarman
THE construction of storage batteries cannot, as a
Truic, be undertaken by the annatur and many others,
because of the costly plant for making up the cells,
such as a powerful shunt dynamo, specially made iron
molds for casting the grids, and a complete lead-burn-



ing apparatus, considerable skill being required in making a good lead burnt joint, because ordinary solder as used by plumbers and tin men cannot be used for storage battery, making. The sulphuric acid solution which is used for the electrolyte would destroy all such joints.

used for the electrolyte would destroy an socn jouns rapidly. The following description will enable any one to make a thoroughly practical storage battery without a lead burnt joint, which can be charged by a current either beavy or light without injury to the positive or negative elements, there being no plates to buckle or grids to break:

clements, there being no plates to buckle or grids to break:

Procure as many stonewere jurs as required for the number of cells to be made. Obtain some sheet lead four pounds to the square foot, cut this into pieces so as to form a cylinder, allowing about three-ciplible of an inch clear space between the inside of the jur and the outside of the cylinder, and pounds the lead full of holes do not be purchased already perforated, so much the better. Bend the lead late a cylinder and rivet a strip of lead cut from the same metal (only not perforated) over the joint where the ends abut. Make this strip three inches longer than the cylinder is high, using leaden rivets made from a narrow strip cut from the same sheet. The strip that is well unake a good connection. Make up sancher eviluder of perforated lead to stand in the middle and rivet the conducting strip upon the inside of the cylinder and the first one, fit into the bottom is place of plain sheet lead, and turn the lower part of the cylinder over to retain the bottom in place. Now met wome scrapicad in a ledic, get it ved hot, and pour it from a height will completely granulated the lead. Make up sanulated lead rightly tight in the space between the perforated lead rightly tight in the space between the perforated clead rightly tight in the space between the perforated clead rightly tight in the space between the perforated cylinder and the jur.

Also pack the inner cylinder full, place on the top

will completely granulate the lead. Make up enough to meet the requirements, then pack this granulated lead fairly tight in the space between the perforated cylinder and the Jack fonce cylinder full, place on the top a piece of perforated lead, and turn the top citize over he had if firmly and retail the granulated lead in place. Now cut some strips of wood the length of the space between the inner and outside cylinders, which should be three-eighths of an inch square, sook them in hot parafine, place these strips so as to refercially separate the inner and outer cylinders.

If only any two cells have been made up, charge them with a mixture of sulpharic acid, one part, and water, ten parts, and couple the atrip of the inner cylinder of one cell of the complete atrip of the inner cylinder of one cell of the complete atrip of the inner cylinder of one cell of the complete atrip of the inner cylinder of one cell of the complete atrip of the inner cylinder of one cell of the complete atrip of the inner cylinder of one cell of the complete atrip the complete atrip the complete atrip the complete cylinder of the complete cylinder of the complete cylinder of the cylinde

made as described for workship lighting. Sometimes as are lamp was used, but generally sisteen candle-power beneathers in lamps were controlled to the consequence in lamps were for the case were fitted into quince bover filled in with coal tar pitch. For testing purposes a current as high as 800 amperes was taken from these cells at 80 volta. In fact, as rough and ready storage cell, simple in construction and high in efficiency, it probably has no equal. The illustration berwith will clearly explain the construction, and any one whising to make a simple storage battery of any size can do so with a successful result. The capacity for the storage of energy can be increased considerably by reversing the charging several times after galaxisting the cells previous to recharging. The inhabiting charge aboutle leave the elements as to positive and negative the same as when first prepared. It will be seen that there are nelliter soldered not hursted lead joints in this cell, all connections being made by lead riverting.

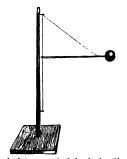
joints in this ceil, all connections near mone by sear riveting.

In the accompanying drawing 1 is the containing jar, B perforated lead cylinder, "spongs or granulated lead, D lead strip and connector, B central perforated lead cylinder packed with granulated lead, F lead strip con-nector. The steel punch best suited for the perforating is a hollow one costing about tensity-five cents. The hurrs that leave the punch can be melted and made into sponge or granulated lead, thus adding in filling the elements of the cells. By placing the sheet lead upon the end grain of a hard wood block the punch-ing can be accomplished readily

An Electroscope Made of a Board and an Old Walking Stick

An Electroscope Made of a Board and an Old Walking Stick

A SENSITIVE electroscope, with which the elementary have of electrical attraction and repulsion can be astisfactorily demonstrated, may be made very easily of the commonest materials, with practically no expense. The materials and the mode of construction may be varied indefinitely. The following simple and interesting method is suggested by a writer in Die Gestenhaber. The stand of the electroscope is constructed by driving the end of an old walking sides tightly into a construction of the electroscope is constructed by driving the end of an old walking sides tightly into a construction of the electroscope is constructed by driving the end of an old walking sides tightly helves of the electroscope is constructed by driving the end of an old walking sides tightly electroscope is constructed by driving the end of the red construction of the electroscope is constructed by driving the end of the red in the end of the red in the red to the major that the end is the red mappin silk is tied at the end of the red in the reason and the end with the free end of the red thy a second filter of such length that the rod is supported in a horizontal position. The free end of the red must now be furnished with a very light half or knob. Two natural vegetable products are singularly well adapted for this purpose. One is the end of the red must now be furnished with a discontinual filter of such a sound of the red woods in many districts. The puff ball is filled with a few cods in many districts.



An electroscope made of a board and an old walking stick.

by the alightest pressure. This powder must not be allowed to enter the eyes, for it may cause severe inflammation. A pull half of the size of a small apple is made on the end of the wooden rod and is pinted with gold broaden for comment, but to give the half a surface of the wooden with a surface of the wooden for comment, but to give the half a surface of the contracting the electroscope, which is now complete. We will begin our expense which has been incurred in constructing the electroscope, which is now complete. We will begin our expense which has been incurred in constructing the electroscope, which is now complete. We will begin our expense such has been incurred in constructing the electroscope, which is now including the wooden cloth and tous electrifying It. and holding it near the glided part ball. The ball immediately moves toward the glass by swinging the hydratoid air me round its axis, the vertical slift filter. This experiment shows that glass, electrified by mishing with a wooden cloth, attracts his unelectrified hody, the gift ball. If a hard tubber pushedler is rubbed in the same way and brought near the ball, precisely the same result will follow. But the following experiments show that the electric charge of the glass is different from that of the rubber. Rub the

giass as before and bring various parts of it into actual contact with the ball, holding the ball steady by grasping the diagonal silk fiber and not letting the hand touch the ball or the horizontial rod. By this operation part of the electric charge of the glass is transferred to the ball. We not electrify the glass tube and the hard vubber again by rubbling them, and present each in turn to the electrified ball, without allowing either of them to touch the ball. We not find that the ball is still attracted by the hard rubber but is repelled, or driven away by the hard rubber but is repelled, or driven away by the plass. If the ball is now touched with the hand, the glass. If the ball is now touched with the hand, the glass. If the ball is now touched with the hand, the glass, if the ball is now touched with the hand, the glass is the product, being the ball in its original unelectrified condition. We next give the ball gasther electric charge by bringing it into thorough contact with the hard rubber penholder, which has been rubbed once more. We now find that the electrified ball is attracted by the glass, and repelled by the hard rubber penholder, after each has been rubbed once more. We now find that the electrified ball is attracted by the glass, and repelled by the hard rubber penholder. These results indicate a difference in kind between the "witrous" or positive cleertic charge acquired by glass when rubbed with a woolen cloth and the "resinous" or negative charge which India rubber and similar submerts prove that two positive charges, or two negative charges, repel each other, while a positive and a negative charge attract each other.

Improvised Disk Talking Machine By C. C. Kiplinger, Instructor of Science, Lincoln, Ill., High School

By C. C. Kiplinger, Instructor of Science, Lincoln, Ill., High School

P. ECENTLY, while studying sound, occasion was had for the use of a gramophome. A very satisfactory in the content of the latter having been made concentric with the airen plate.

This plate turns on a pln, to which, ordinarily, it is tightly clamped by a thumb serwe. However, this was left loose, the plate being turned by the friction of the pin in its bearing. This adjustment gave the table a certain freedom of motion and, owing to its inertia, or fly-wheel action, the rotation was rendered very uniform. The reproducer was unique for its simplicity and surprising efficiency. It considered of a thin cardinoard, or a content of the content of the



Improvised disk talking machine.

may be usal, geared about four to one. The turning table should be rather heavy, and rotate loosely about a shaft, as described above. This reproducer, if properly adjusted, will give results equal to many of the higher priced machines on the market.

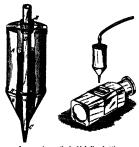
A Good and Inexpensive Method of Labeling Bottles Intended for Corrosive Liquids By H. H. F. Clarke

By H. H. F. Clarke

CHEMISTS and others who are engaged in laboraturies, chemiat shops, etc., often require a label which
will not wear off and is not attacked by corrosive liguida.
The ordinary method of covering printed paper labels
with parafile was or variable is worthless when desling with liquids such as sulphuste acid (oil of vitriol).
Also bottles on which the labels are sandhisted are so
expensive. (30 to 75 cents for quite small once) as to
be beyond the pocket of many. In the following way,
however, with a small amount of trouble and hardly any

cost, bottles may have indestructible labels samillace on them. These labels, if done with care, will be for to be equal in durability and appearance to the mi-expensive bought ones.

to be equal in durability and appearance to the most expensive bought ones. A small timed term funnel of 1-16 inch diameter A small off is taken and fitted with a barrel instead of the usual collar. Before this barrel is fitted, a cross piece of tin, H, is soldered on one of the ends. This serves to keep the quast tube in place. On the other end of the barrel another stray, F, is soldered. In this one the hole must



sive method of labeling bottles.

le larger than the first case to allow the cork \$E\$ to pass through. The object of the cork is to prevent the glass tube \$D\$ from slipping down and so blocking up the orifice of the Tunnel.

Now take a piece of ordinary glass tubing (½-inch disameter) and draw out one end. Then cut the reduced portion with a file so that the orifice will be about 1:16-inch disameter. When this is done the piece of touch the cord and then cord and the cord and then cork and then put them both through the hole in the ork and then put them both through the hole in the ork and then put them both through the hole in the first strap. Push the cork is firmly and then press the tube carefully until it passes through the other strap, which keeps it in piace, and comes to within a time to the cord and then press the tube carefully until it passes through the other strap, which keeps it in piace, and comes to within a time to the cord and then of the cord to the finnel.

It is better if the sand is affect through a piece of from gause, about \$3 or 30 mesh, before using. This removes all the humps, etc. which would, perhaps, block up the orifice. Connect the wide end of the glass tube to an ordinary foot bellows, glving a pound or two pressure per square inch, with a piece of rubber tubing.

Now take the bottle to be labeled and paste or gum a couple of thicknesses of brewn paper at least half we have a special to the content of the co

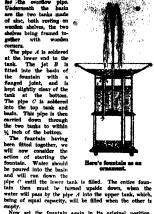
used must be thorrough, and a ready and a

becatory Departme sinc. Is inches in a such hole in the co

This slightly to one state for the overflow pipe. Vadermenth the basin are the two tanks made of sinc, both resting on wooden shelves, the two shelves being framed to-menther with

shelves being framed to-gether with wooden corners.

The pipe A is soldered at the lower end to the tank. The jet B is fitted into the basin of the fountain with a flanged joint, and is kept slightly clear of the tank at the bottom.



being of opial capacity, will be illed when the outer in-empty.

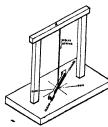
Now set the fountain again in its original position, Now set the fountain again in its original position, when the basin will gradually fill with water, which will rash down the pipe of, thereby compressing the sir his the lower tank, and forcing the air into the upper tank water in the pipe of the compressed sir acting on the water in the upper tank to the compression of the pipe of water in the upper tank in the pipe of the pipe of water in the upper tank water in the top tank has been forced through the jet. The upper tank may be refilled by reversing the fountain.

A Simple Hygrometer

A Simple Hygrometer

W for five hear of goose bones, rheumelians, and old
wounds being used by their owners as haccuseters,
and it reports are true, they hever fail to predict accurately; but as the last two at least are apt to register
tother things than changes in the weather, the Handy
Man who wants a home-made barometer would do well
to leave them alone. As a matter of fact, it is the moduter in the atmosphere rather than the atmosphere pressure that is indicated by auch means.

A satisfactory bygrometer can be made at small cost
and in a short time in the following way: From a cross
piece suspend a pointer weighing about two ounces by



A simple hygrometer.

a violin string four or five inches long. Set it in a where the outside air can reach it, and the pointer swing from side to side as the weather changes. ... several days' observation a scale can be marked or

This is the simplest form in which it can be made can be worked up in more elaborate designs, a far example of which are the liftile German weather it which are to be seen in the store windows.

ction of Nitric Oxide

Lagrandenies of Niete Orden

A LaTTER from Prof. Gridges, which we public
A not best of Followary Sith, has brought to a
pietoe from Mr. R. H. Seech, in which he wis
clast the Wille be gave to the addition which he wis
to ver lesse of January Sig you at severe.

A standard by most "the Lagrandenies" of Principal

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The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting



mtor and the Patent Office

The greenest men the Falenchies upon which it the dominated in the supresset of this nation. It is the considered are there diships which are mentioned in the Constitutiong of the United States (Bratt the granting of free speech; second, the offer of reasureration for the use of the products of the brain by providing, a limited period during which a man shall enjoy the fruits of his efforts; and third, the protection of personal property by the provision that no person shall be deprived of his property without due precess of law.

he Constitutional provision mentioned as mid is as follows: "The Congress shall a power . . . to promote the proghave power . . . to promote the prog-ress of Science and Useful Arts by scour-ing for limited Times to Authors and In-ventors, the exclusive Right to their respect-

sing for limited Times to Authors and Tosections, the escalevier Right to their respecttive Writings and Discoveries."

Upon this foundation stands the United
States Patent Office, established for the
States Patent Office, established for the
superpose of extraping out the intentions of
the framere of the Constitution and decolored the property of the Constitution and detop of the property of the Constitution and detop of the property of the Constitution and detop of the property of the Constitution and dewith the Nation and which has been handed
down to him as a heritage to encourage his
talents and develop his idengle. The entire
process by which every though the tenter
states may profit by his country's laws as
a far as they apply to the protection of
his inventions, should the them, to give a
top of the process of the Constitution of the control of
from the time that the inventor has perfected his conception, to the time be is
handed United States Letters Patent, givage him seveness years of uniterrupted
countried over that which he has coulved.
Let us suppose that our familiar friend
"John Smith" has imprise and can be
from the Nation and which has been handed
United States Letters Patent, givage in attention
for the previous
to the everalistic of the United
States may profit by his country's laws
as far as they apply to the protection of
from the time that the inventor has perfected his conception, to the time be is
handed United States Letters Patent, givage in terruptions of the United
The Company of the United
The Compa

which muss worked long and hard over his device, and he sees in its consummation a future of ease and comfort for himself and his family. These are not vain lopes nor Idle visions, because he know that people who invent new and useful when money.

sat people who minds make money.

The first thing the inventor thinks of, nowever, is that be must have his inventon protected so that he alone may enjoy he first of its success. Not that he is of the head of the money is not the head of the money in the success. The first thing the inventor thinks of, however, is that he must have his invention protected so that he alone may enjoy the fruits of its success. Not that he is of an anduly suspicious nature, but the American inventor combines with his genius, a goodly portion of that desirable characteristics—common sense.

ican inventor combines with his genius, a goodly portion of that desirable characteristic—common sense.

To whom shall he first turn? To amanufacturer of hetties? Not yet, for he does not know what manufacturer of hotties he can trust with his great discovery. To a whisky of a patent medium of the sense of the sense

it is not one of the requirements of law that an inventor shall employ a patent attraction of the control of th

the Patent Of-fice, patent at-torneys and their assistants sit and

satisfatuts sit and delve through the succession of the device through the records. It is a larget that families the records. It is a larget that families to fit the day, and it is a sight that families to fit the day, and it is a sight that families to it is a sight that families to fit the day, and it is a sight that families to it is a sight that families that makes it possible for the inventors and the makes it possible for the inventors and the devices of those who set to dispare upon the methods and the devices of those who have tred the paths of invention before them. The search completed, the attorned that the day of the formation of the paths of invention before them. The search completed, the attorned that the day of the day of the formation and drawings and these are forewarded to the Patent Office attached, all ready proper of patients that shootly has inventionally an authorizes his attorney to prepare the specification and drawings and these are forewarded to the Patent Office attached, all ready proper of patients of the continuation of the paths of the paths of invention before the continuation of the paths of the pa

a piece of marketable property, is already at work.

The Application Division of the Patent Office first receives those papers. It is here that they are duly entered to the property of the p

From the Application Division, the fee having been properly receipted for by the financial clerk, and the money deposited in the United States Treasury, the papers now the United States Treasury, the papers now go to the examining division. There are forty-three such divisions in the Patent Office, representing the various classes of inventions, and each is in charge of a prin-cipal examiner, who has a corps of skilled assistant examiners. In the case of "Smith" the application is sent to the division where all kinds of bottles and jars are examined. The se-teral particular companies of the con-formation of the control of the con-trol of the con-t

closed The The drawings are compared with the specifications with painstaking care, and the examiner makes an examination of the class to which the device belongs, an exportuntues for others to manufacture almost the same device, without actually inmost the same device, without actually infinging his patent.

"John Smith," we will suppose, adopts
the remaining and wiser course. He enspaces an attorney, and this attorney will
make the "perchimatory accessed." The resmakes an attorney, and the attorney will
make the "perchimatory accessed." The resmakes are a server in the Search Room by the applicant's attorney. In the examiner's case the search
make the "perchimatory accessed." The resmakes the search of Greet Britain. France, Germany, Switzerto ottotorper "John
Smith" idea has
been already pat-

Germany, Switzer-land, etc., and the publications in the Scientific Library. When the assistant examiner has examiner has reached a con-clusion, his work is reviewed by the principal ex-aminer, and the applicant is noti-fied, through his attorney, of the result of the con-sideration given sideration given

the case.
Supposing that
the bottle stopper
is found patentshle, the examiner now passes
the case to Issue,
and it is ready
for the Issue and and it is ready for the Issue and

nery in the sea active water has a public med.

The most person of the way and the sea through the public flower a patient goes through the public flower is, of course, haude on the supposition that there are no obstacles in its way. If, for instance, the examiner should find certain prior patents, which, in his opinion, anticipate "Smith." bottle-attorper, he enters into correspondence with the attoracy, and it then becomes the business of the attoracy to adjust the daims to of the attoracy to adjust the daims to Then objections are usually availly swere-come, but in some cases adjustment is impossible and the application in finally rejected.

Sometimes the examiner's objections are

case is recalled in which the examiner ob-jected to a claim as being too indefinite lie promptly replied and requested that the examiner indicate just how indefinite a

can might be the man to represent that the canoning the best actions in a matter which is of so much calm might be. But it does not make the facetions in a matter which is of so much call importance as a patient application.

The correspondence of the Patient Offler, like that of any large business bouse, includes many letters and inquiries of the "freak" variety Members of Congress are besought by their constituents to do all sorts of impossible things. "Please go to the Patent Office and get me a patient," writes one constituent, a dweller on the edge of civilization. He thinks the Congressman can wait until the patient is made edge of civilisation. He thinks the Con-gressman can wait until the patent is made out and handed to him, and drop it in the mail hox on the spot. The matter of searches, specifications, fees, amendments, etc., disturb him not at all. And the class of mentors of this kind is by no means small It seems to be a peculiarity of gentus to know nothing at all of formal procedure.

The inability of the inventor properly to describe his device, or adequately to picture it, causes his attorney much embarrasament, and involves a correspondence of large

and involves a correspondence of large dimensions.

Cases which have been finally rejected may be appeared, first to the Examinera-final-Chief, who must review the findings of the primary examiner, and hand down a written decision. The Board of Examinera-final control of the control of the

An interference is a proceeding in the nature of a suit to determine which of two or more parties claiming the same inven-tion is the first inventor. The interference the reproductions of the drawings, already patter of a suit to determine which of two prepared by the photointiverapier, enclased in a cover in hook form, with the continuous c



proofs and take their testimony. Some-times before doing this they realize their positions and adjust the matters between them. One case is recalled where a promi-tent captain of industry in a western State made an important invention along the line of his business. An associate made an in-vention at about the same time, and the two assigned on interest in their respective in-



C. C. Billings, First Assistant Co of Patenta.

ventions to each other, neither knowing what the other had invented, and the applications for patents were duly flied. When the inevitable interference was threatened, the capital of industry said to his asseriate: "Look here, these are our applications. Let's go to Washington and fix the may to Washington coordingly came all the may to Washington could not be supported to the first inventor when their preunlary increase in the inventions were already preserved.

the tiral herent were already pre-terests in the inventions were already pre-in taking the testimony for the differ-ent parties, some of which is a highly tech-nical matter, required to be in strict ac-cordance with the pattent rules, the witnesses are examined and cross-examined, just as in depositions for other suits, and finally, after all testimony has been taken, the cases come on for hearing before the Examiner of Interferences. Prior to this the testimony and the breefs in behalf of the interfering parties must be printed, all of which involves expense and necessitates the assistance of skilled, trained attorneys. The Examiner of Interference then ren-ders his decision as to the matter of priority, limit of appeal is faced and appeal may be taken within that time to the Board of Examiner-sin-Chief, who, after the case is fully argued, render their decision. Then to the Commissioner of Patten in prema, and from the Commissioner's decision to the Court of Appeals of the District of Co-lumbia.

Court of Appeals of the District of Co-lumbia.

Sometimes in the course of an interfer-ence, one of the parties will endeavor to change the date of his conception of inven-tion on the record. When this attempt is made after he has had full access to his opporant of the reason for made the proposal of the property of the property of that is unimperchalde, since the courts have held that mendment upon so important a point should not be allowed unless it is shoun that the interests of justice clearly demand it, "for upon the determination of these dates," such the further of Appeals of the District of Columbia, "it depends, in the majority of cases, which party is con-tified to the patent, and a change of mem-ory is comparatively easy when acli-interest dictates a different date."

dictates a different date."

If will be seen, therefore, that the Patent Office and the Courts are fully awake to their responsibilities in protecting the inventors. One feature about the appeal to the Court of Appeals of the District of Columbia is that such court has no power to attach costs against the lossy party, so that the entire cost of taking the appeal to the court is on the appealing party. Of course, it must be remembered that interference proceedings are extraordinary and are not often encountered in applications for pates. The higher ramifications of the progress of an application through the Patent Office, present many aspects of law and technical contracts.

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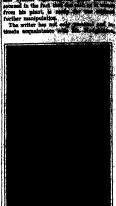
nical procedure, and the precitics involved is both interesting and intention.

A large majority of inventions, however, find that their applications wan to a paceasary to secure the coveted claims, but in the hands of capable attorneys, those are easily made. The hand of the Patant Office is ever outstretched in behalf of the inventor, and his interests are carefully conserved, indeed, the first head of the Patant Office, Dr. William Thornton, held the theory of the conserved indeed and the process of the conserved indeed and the process of the conserved of the process of the process of the conserved of the process of the process of the conserved of the process of the process of the conserved of the process of

The Hodgkinson Salt Process

I N recent newspaper dispatches it was a stated that the United States and Canadian rights in the invention of Mr. James Hodgkinson, of Manchette, England, had been sold for a large sum of money. The invention is revolutionary, and as somewars of experience and development by a practical man in the business, it is really an inspiration received by Mr. Hodgkinson in a visit to the salt works. He saw at once that the antiquated and expensive method of producing sait could be supplanted by a simple process which would save enormously in fuel, and in the handling of the sait. It is one of the instead of the instance of In recent newspaper dispatches it was a stated that the United States and Can

ber, but in the credient partial to vise by pumping the british into pans, and providing a furnish for or pan with a big stack or chis water being slowly evaporated crystals precipitated. This was which being slowly overported and salf-cryptals precipitated. This was not only, slow, but very expensive, and required pretty nearly, if not quist, a ton of oasi, to produce a ton of salt. Another serious objection to the old method was that the crystals were of irregular size, and hence to get them fine enough for oue as table-salt, for instance, it was necessary to grind them, which was objectionable for-many reasons first, hocause the salt, after-being grounds and the salt, after-being grounds and the salt, after-being grounds and the salt of the grades varying as to size of crystals, and used for different purposes, according to the special requirements, such as butter salt, shis salt, and the like. evaporated and sait This was not only



Assistant Commission Frederick A. To ner of Patents

but had the pleasure of a vialt with him last year, and visited Northwich, the salt district, and inspected the remarkably competence of the process of the

Brief Notes on Inventions

The Bible as a Patent Reference.—
The late George Seely examined the class
of electrical distribution and had charge of of electrical distribution and had charge of electrical conduits during the modern de-velopment of that art. An applicant, early in the history of the art, presented a con-duit of wood coated inside and out with pltch, and it was promptly refused by Mr. Seely on reference to the fourteenth verse and the seed of the contract of the con-plete the within and without with pltch. The within and without with pltch. Twent-Early the Twent-tenther, the Metal Twent-Early or the con-

pitch it within and without with pitch."

Invastigating the Match Trust.—Following the recommendations of Preddent
Taft, looking to the prohibition of the use to the prohibition of the use to the prohibition of the second of its delicentous effect upon the health of the action of the delicents effect upon the health of the action of the delicents adopted on February Bith, 1911, a joint resolution hwing for its ebject to secure an investigation of the so-called match trust. The investigation is to be conducted by or under the direction of the President, who is authorised to consider those features of the present mode of manufacture which affect the health of the employees, how the dangers to the employees can be minimized by the use of substitutes for white phosphorus, and at oany exhibing patent protection for such substitutes.

**Familiarity Preceds Contends for Necessian

hag patent protection for such substitution.

Familiarity Broods Contemps for Nonmary Improvements.—It is not always the
one most familiar with a subject who sees
the contemps of the subject who sees
the substitution with a subject who sees
the substitution of the substitution of the
travelling man told the vertice be spent, sees
thandled nights a year on a sleeper. When
I saked him to other the sees improvement
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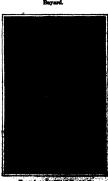


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r-in-Chief Fairfax

Action Comments of the Action

described to all galaxies. The second createstant of the second createst to the second createst of the second crea

The world's Radios of Partents bound by the Units Scottes Philips States will be found to the Scientif

The state of the s

Sheetsted Beginner, and the state of the sta

aposide tools.

**XELFARM SELFS INDUCTION COIL.-A.C.
Horse, Telebrag, Ps. In this case the invention solution to variable self-induction coin; the month self-induction coin; the month self-induction coin; the month self-induction coin; the coin self-induction purposes being to provide a fact of provide as you would set to dispuse with a feedbadg coil, and in which the voltage may be readily cointrolled at will.

COOP.—Milzon I. Stokes, Terre Haute, III.
The coop shown in the engraving is easily kept
in a clean and maintary state. The invention in
general consists of an open base, triangular
ends and sides; the ends and sides hinged to to seat on the ends when the the base and fulding ther



CHICKEN COOP.

the transd upright, and form in connection therewith a coop, the sides such having ridds side hars and refluciated covering, fratheres arised bar and refluciated covering, fratheres arranged on the side hars of the sides, and a ferzible covering for the sides adapted to be detachably applied thereto by the fasteners. STUMEY BRADICATOR—M. B. Prassians, Kellong, Idaho. The invention refers to a stump remover, of a type adapted to form a furnace around the stump and destroy the same by fire. An object its to so construct the device that an opening will be presented to the device that an opening will be presented to the device that an opening will be presented to the device that an opening will be presented to the device that an opening will be device. The simple of the simple si

to cause a section through the device.

WING CARBIER.—T. I. CURMINES, Specier, Joya. The invention provides means for folding carriers to nest upon the structure of the threating metches to which they are applied; provides for varying their operative positions; provides a driving mechanism for a pissellity of carriers operable from a single source; provides reasonable gride hoards for oriviens and means connected therewith for the provides of the carriers of

Of General Entervet.

Kill HARDIS SQUARE.—J. Hann, New
Tork, W. T. fa the present patent the favortion is an improvement in square section are
wald in determining the eleanance on disa, by
skills, in maintent the angle of the rides of the
Mr. Higherman, and has in view a square in
which the below may be accurately and condity
the light hade by the rides drifts, certain

Programme of the control of the cont

chaser.

APPARATUS FOR ENRICHING GAR—B. A. DIFFRALX, Seattle, Wash. The sim of this inwrition is to provide an efficient apparatus for
maintance reposes and continuously. The case
maintance reposes and continuously. The case
maintance of the seat of the seat
sattable shape, size and material; the fast
having poor hard conducting qualities, preferably fire clay. An advantage is, that is the
sectual operation of the suparatus, the chamhers are alternately mixing and combustion
chambers are alternately mixing and combustion
chambers.

chambers
PABRIC HOLDER AND EXHIBITOR.—
PAMRIA A. RARRE, Haston, Neb. Means provide in the apparatus shown, for eliminating all creases and wrinkles, or, in other words, the fabrics are smoothed preparatory to winding on the vahibiding rollers. Each fabric roller has a grove for use in holding an end



of the goods or fabric when trying to roll it, the ends of the fabric being inserted in the groove and held therein by friction, so that it is prevented from slipping when the roller is rotated. Each roller has two guides set a distance apart corresponding to the width of goods to be wound, the being assumed that in cases fabrics of different widths may be wound in the same operation. Each guide has delicited to the world and the control of the control

fabric unwinding accidentally.

SHELFA ATRACHMENT FOR TENTS.—W.
C. BROWN, U. S. ATRIY, Washington, D. C.
The invention is embodied in a useful and inthe invention is embodied in a useful and incretangular plan with a wall, such as wall
tests, common tents, and boaptiel tests used
in the U. S. ATRIY, the same serving as a supporter or holder for various atticles used by
porter of holder for various atticles used by
DINNER PALL—RRY, W. A. BOWARDS, Piles
DINNER PALL—RRY, W. A. BOWARDS, Piles

ble with the seat DINNER PAIL—Ray. W. A. Rowanse, Pine Binff, Ark. An object here is to provide a device in which there are a number of separativity for carrying food, with means for venitiating each tray. The trays are resdily accessible and means provided for locking them when in postion. Carrying means is arranged for liquidis in such a manner that the latter cannot be removed until the course in relaced.

for leguds in such a manner that the latter cannot be removed until the over is raised.

FORM FOR THE CONSTRUCTION OF CONCERTE WALRS, PLOOMS, CRUBB, GUTTERBA, AND LIKEN STRUCTURES.—M. B HOWNERS, BERNSON, N. T. The Intention in the improvement in the PROCULINES. BERNSON, The Intention of the Control of the

PAPER ROLL BOLDER AND CUTTER.—

RAYMOND P. HENDRICKROW, 232 Washington

Avenue, Brooklyn, N. Y. The object here is to

provide a holder and cutter for rolls of pape.



or the like, by m a, by means of which the roll can by supported, which serves for sev-tibe roll pieces of different lengths, a required, and in which the binds

is morehly mounted so that it maintains a constant angle with the horizontal, regardless of the thickness of the roll, whereby it is possible to sever pieces from the roll with equal facility at all itimes. The derive illustrated herewith is for use with rolls of paper or other material which is used in pieces severed from the rolls.

MAGAZINE PLATE HOLDER.-R. GOLD

KNORT DEATE HOLDER.—R. GOLDERS.—N. New York, N. Y. The plate holder is arranged to hold a plurality of sentitive plates without danger of the same becoming interest without danger of the same becoming light service, and to allow of conveniently frameter and the sentitive plates. In the sentitive plate of the sentitive plates and an intermediate member, having cut out portions for forming individual chambers for the reception of the sentitive plates.

DBRHICK.—G. PRING, Seattle, Wash, While she bot of their types, as, for instance, my derricks. The objects here are to reduce cost, to render the senting senting the senting of the senting senting senting the senting sentin

Hardware and Tools,

Hardware and Tools, CLASP.—S. S. Killey, Kolly's Cove, Nova Rootla, Canada. This invention is an improvement in classes suitable for clamping articles generally, but respecially adaptable as a holder or class pin a cover at the class per a cover stall, the class pendodying two approximately II-shaped clamping members of spring wire, with the same of the members swinging to and from each other members swinging to and from each other which are provided with intermediating, gripping helices, to engage the article to which the clamp is applied without danger of cutting.

ping helices, to engage the article to which the clamp is applied without danger of cutting.

HAMBRE—A. GRAFT, Rewills, "reasons a second to the handle in such manner that the head cannot fly off the handle, and this is done by constructing the head with a laterally opening down-tail or under-cut reverse with its smaller end open and leading from the lower hand off tiles, the reverse and the tree that the smaller handle is a smaller with the smaller handle is the smaller handle in the smaller handler bend them from the body of the leaf under or dinary strain.

dinary strain.

FOLDING CHAIR.—B. G. KRITS, San Francisco, Cal. The purpose here is to provide a form of chair that may be made so that the lase and the sext can be separated and compactly folded, and wherein the sext and back stays may be removed and readily replaced, and wherein when the sext and back sections are properly placed upon the base section lie-chair will be as time as a one-piece chair.

chair will be as firm as a one-piece chair.

PIPE Wateroli - E Russage, Iltiteport,
lows. The invention comprises a fixed jaw
on the wreach head and a morable jaw
carting therewith and having a shank that is
movable transversely in an opening in the
head. The shank of the movable jaw has a
side that carries a spring paw 'engaging
ratched beth on the shank for holding the
movable jaw in the adjusted position.

Household Utilities.

Mousehold Utilities.

COMBINED ROLDER AND RECEPTACLE.

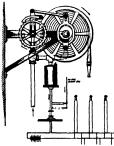
—ADDURT GRADER and GROSSIS GRADER, S18
John Street, West Holoken, N J. The object
of this lavention is to provide a combined
holder and receptacle, particularly adapted for
use on gas sloves, the holder being required
to hold the gas howe and the receptacles to
clavelently hold matches. For the purpose
monthood use is made, as allowen in the car-



graving, of a body provided with a clump, and recognicies secured to the body. A hood in the beads of matches from any best radiating from the store. The other receptice holds the ends of matches used to light the gas

UMBRELLA BTAND.—P. P. MOMENAMIA, Jersey ('Ity, N. J. The invention pertains to stands for universita, cames and the like, side control of the stands of the like and the like, side of the like and the

Machines and Mechanical Devices. COMBINED 1108E REEL AUTOMATIC WATER DISCLARGES, AND FIRST ALLEMOND. A. HEN, P. O. BOY 108, Charleston, Wash. In this pertent the invention shown in the Hillscrafted facilities as five hose-reel and stackments so constructed and condising that stackments so constructed and condising that attachments so constructed and forms of the reel, a value controlling discharge of water is as



COMBINED HOME BEEL, AUTOMATIC WATER DIS-CHARGER, AND PIRK ALARM.

tomatically opened, and an alarm is also sounded automatically in one or more rooms in the building where the apparatus is lossed. It is simple in construction, really operated by any unablified person, and it sparticularly useful in horist and losting bouses or wherever the life is constantly to give an alarm in a series of rooms or places.

of rooms or places

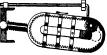
JABRING IRURII FOR WOOL COMMERS

—T. K. LEE, New York, N. Y. In machines of
this type a pair of dabbing broubes are mounted diametrically opposite to each other, and
the machine is constructed in such a way that
the brubles, the wool being earried upon a
horisontal circular support or where which is
rotated by a step-by-step movement upon a
central axis Means provide for attaching the
brush to life holder and the literature and the
control of the holder and the literature and the
control of the holder and the literature.

Prime Movers and Their Accessories,

Frince Stovers and Their Accessories.

STARTING DEVICE—JOHN P. LOOMER, Rural Free Delivery No. 1. Buckhoits, Texas. The invention pietured herewith relates to starting devices particularly adaptable for internal advices to engine, and the afth is to predict advice to engine, and the afth is to predict advice to engine, and the said to pied of the property stored up by the said engine when



STARTING DEVICE WOR INTERNAL COMBINETON

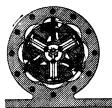
PERSONAL FOR PARKA CONSERVED.

PREVIOUSLY IN operation. Use is made of a pition for rigid attenhent to our end of the shaft of an englise, an intrinsity toothed rark which is a state of the shaft of an englise, an intrinsity toothed rark which is an extended root in unasarment with a spring, means on the rack for holding the pition in an extended root in unasarment with a spring, means on the rack for holding the pition in an operative position relative to the rack, and means engaging the rack for connecting rack, and in means the bear substantially compressed.

CHOLER FOR INTERNAL COMMISTION EXPORTANTIAL COMMISTION FOR THE PARK TO SENSE AND THE PROPERTY OF THE PARK TO SENSE AND THE PARK TO SENS

BOTABY ENGINE,-JAMES H. WATSON, BOX

88, Riverton, Wyo. In the present patent the shipert of the invention represented by the en-graving is to provide a new and improved ro-tary engine, arranged to utilize the motive agent to the faillest advantage and to pro-erly govern the speed of the engine. In order



BOTARY ENGINE.

to produce the desired result, use is made of a cylinder provided on its inner surface with spirally arranged cavities for the motive agent to pass in, and a rotor mounted to turn in the said cylinder and having heads in the form of revolutie star wheels in mesh with the said cylinders.

WATER IGNVENNOR.—A DICESSEON, American Pork, Vitab. The lavestion of this parentee is more particularly itemed for spull-cation to a pump to automatically control the ann. A plunger is provided, having spaced, and the plunger. Passages and suitable ports connect the space between the plunger heads with the adjacent used of the cylinder in which the adjacent used of the cylinder in which the controlling the ports. There is a connection between the space between the plunger heads with the adjacent used of the cylinder in which the controlling the ports. There is a connection between the spure the exhaust not seen the controlling the latter, to simultaneously close the intake and operating the latter, to simultaneously close the intake and open the exhaust not seen and of the cylinder, so that the entering shuld will shift the plunger Suitable connections control the prime mover.

Railways and Their Accord

Bailways and Their Accessories.

CAR COUPLING.—J A REARM, Tyrone,
P.a. In car couplers of the Matter Car Buildpart of the Matter of the Coupling of the Matter of the Coupling of the Matter of the Coupling of the Matter of the Matter

Insecure.

MAPETY DEVICE FOR RAILWAY TRACKS
—Ins. R. E. CARLYON, Latoule, Ky., and M. W.
RYAR, Blaimones, Texas. The Unprovement is
in guard rails for preventing derailing of cars
An object of the invention is to provide a device which may be advantageously used at
points at which there is danger of derailines,
points at which there is danger of derailines,
which is a provide and a state of the control of the control

structure. A further object is to provide
electrical means for nutifying the operator if
the derailment should occur and at what point

the destillment should occur and at what point Designa,
D

produces the acroplane in a kite design DERIGEN NORA A KETUSE, AND SCAND M. WENTERADE, New York, N. Y. This design of a kettle and stand is a beautiful over to or namentation. Above the body of the kettle stands a serolice handle, and the whole design including the four-legged stand, is covered with allowatic garden seeses with human figures, flowers, when beade, vive, in good teste and

NEW BOOKS, MYC.

REW SOURS, ST. 18.
Restract Cutton Lemant. New York: The Outing Publishing Gungary, 190-1910. 14moc, illustrated. The Book of Camping and Woodcraft. The Horace Kaphart. 381 p. Camp Cookery. By Horace Kaphart, 154 pp. Bankwoods Surgery and Medicine. By Charles Stuart Moody, M.D. 160 pp. Price, 4.

pp. Backwoods Surgery and Medicine. By Charles Start Moody, M.D. 100 pp. Price, 44.

The editor of owing select these as three of the best outdoor books in America. From the outlet of the details of causy life, to the treatment of womes, frectures, and possible man been covered, and its hardings and accidents rabbed of their terrors. The little volumes may in obtained separately or, as quested, nucleosed in a heavy cloth case which makes of them a compact package. Treatment, and the man compact of the property of the control of the control

the different game birds, and a final word on field etiquette.

A MARUAL OF PRACTICAL ASSATING. By the late H. Van F. Purman, E.M. New Yark: John Wiley & Bons, 1910. Swo., 530 pp., illustrated. Price, \$3. the price of the reception the relation of the reception the relation to the

Bables.

Desiron of Marine Multivious Las Boitzes.

Desiron of Marine Multivious Las Boitzes.

Desiron of Marine Multivious Las Boitzes.

W. Brown. A.M.I.Meels. E. New York:

D. Van Noetrand Company. 870; 48

pp. Price, \$1.50 net.

For the bonest of merine engineers, marine dreughtseens, and students, who are without large to the state of the state of the large state of the state of the large state of the lar

ELEMENTS OF ELECTRICITY FOR TECHNICAL STUDENTS. By W. H. Timble. New York: John Wiley & Sons, 1911 12mc.; 556 pp.; illustrated. Price, \$2 net.

12mo.; 506 pp.; Illustrated. Price, \$2 met. Institute classes have for a number of passes been taught from the miner-graphed noise upon which this text is based. Mr. Timble regards the results as justifying the mode of presentation, although he similar than the mode of presentation, although he similar than the mode of presentation although he similar than the mode of presentation and the criticism of mot being quite logical in its order. That it is teachable he avers the results demonstrate, A great dead of information is given in the contract theory; it provides auxiliarity and in the presentation of the property for spaying what he has learned; and to applying what he has learned; and to have a surface through the property for spaying what he has learned; and to have a fine the property of the price of of

draulic manhinary, the sent of plans and flip power plans, electroschildre all their rapids, as and many more, are distincted, with a smittle the of information, tables, and disagrams their, and on selecting the size of the host, is listle giver at a wonderful.

woodsrful.

CHR TOUNG ELECTRICAR. By HERRIDICAR
Hall. New York: The Measurilles
Company, 1910. Swn.; 188 pp.; itlustrated. Price, 11.50 met.
The author's aim is to afford "instructive
amount to intelligent keys." Biarring with
solutions of the company of the control
certifical science. he lands the reader of
through the simple experiments of attraction
and repulsion, of the electrocope and the Leydon lart, to such processes as electrotyping and
shetroplating, and to such devices at the tellment for wireless telegraphy.

A TEXT-BOOK on Previous By H. B. Kurgel.

reph, the dyname, and the necessary equipment for wiress telegraphy.

A TEXT-BOOK OF PHYMICE. BY H. E. HUTST, M.A., B&C., and R. T. Lattey, M.A., New York: D. Van Nostrand Company, 1810. 8vo.; '8 pp.; Illustrated. The preliminary samulation in physics in the preliminary samulation paper of Chanbridge University, London University, and the Military Materiae Hamiltonian paper of Chanbridge University, London University, and the Military Materiae Hamiltonian, The source of the questions, and the year in which they were set, are indicated in heretex. The characteristics is a simplest has been given the perfector. The divisions of the work are "Dynamics," "Heat," "Sound," "Light," "Magnamic," "Station Bectricity," Overvet Ricerticity," and "General Physics." Dilagrams, insert, and Culpage Illustrations supplement and clarify the text.

DYNAMO ELECTRIC MACHINERY. Its Construction, Design, and Operation. By Samuel Sheldon, A.M., Ph.D., D.Sc., and Erich Hausmann, E.E., M.S. New York: D. Van Noetrand Company, 1910. Svo.; 338 pp.; illustrated. Price, \$2.50 net.

1910. 8vo.; 338 pp.; Illustrated. Price, \$2.50 net. This is an eighth edition, completely rewritten, and considers only direct-current matchina, and considers only direct-current matchina. Volume of uniform binding. This text-look is intended for the use of students "pursuing electrical and son-electrical engineering courses, and the requirements of the classroom have been kept in view. The arrangement is such clerifical course would not be required to sindy, may be passed over without disturbing the sequence of the remaining matter. From electrical and magnetic laws and facts, we pass to chapters on armatures, field magnets, good chapter is devoted to contral-station equipment—out; installment, cost, selling price, and operating expasse.

THE AUTOBIOGRAPHY OF AN ELECTRON. By Charles R. Gibson, F.R.S.E. Phila-delphia: J. B. Lippincott Company, 1911. 18mo.; 216 pp.; illustrated. Price, \$1.50 net.

1911. 18mo; 216 pp.; Illustrated. Price, 81.20 met.
This true fairy tale of the latest theory of science seeks to do for the skettron what care the second seeks to be seen to be seen the second seeks the partial. Prom the time when seeks the partial second since were when the partial second sleever when the sections of the electron revolutionshed the sechasical theory of the constitution of matter, the tale logically and progressively unfolds from weak the second seeks the seeks the second seeks the second seeks the second seeks the second seeks the seeks the second second seeks the second seeks the second seeks the second seeks the second second second seeks the second second

The Story of the American Menchant Marine. By, John R. Spears. New York: The Macmillan Company, 1910. 8vo., 340 pp.; illustrated. Price, \$1.50 net.

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Parricuras and Danson and Assistantian Company Herebert Chasties, New Paris, "Di-Trial Neutranal Company, 1921, "Smither Blast." Neutranal Company, 1921, "Smither Blast." Neutranal Company, 1921, "Smither Blast." New York Control.

The Control of the Control of

THE BOOK OF WHEAT. By P. T. Dond-linger. New York: Orange Judd Company, 1908. Small 8vo.; 369 pp. Price, \$2.

linger. New York: Orange Judd Company, 1908. Small New, 360 pp. Trice, \$3.

Trice, \$3.

Trice, \$3.

Trice, \$3.

Trice, \$3.

Trice, \$4.

Tr Mr. Them mode of presentation, although he sellists, the mode of presentation, thirough he sellists, the mode of presentation, thirough he sellists, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and that it may parhaps be open to the critic, and the critical parhaps and the critical parks and the critical problems to develop in the students of the beginning," when the 80-ten sea and ton is applied to substantial ends, not to required in applied to substantial ends, not to required problems to develop in the students of the beginning, when the 80-ten sea and ton is applied to substantial ends, not to required in a parks of the critical problems to develop in the students of the critical problems to develop in the students of the critical problems to develop in the students of the critical problems to develop in the students of the critical problems to develop in the students of the critical problems to develop in the students of the critical problems to develop in the students of the critical problems of what particularly of the critical problems of white problems of what particularly of the critical problems of white the critical problems of what particularly of the critical problems of white the problems of white the critical problems of white the critical problems of white the critical and accommission of the critical and contains and visible data and containst relating to the problems of the problems of the critical and containst problems of the critical problems of the critical and containst problems of the critical problems of the critical and

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COLAL Marrie Branch Of U.S. A ATTION - Spacedon Marrie Branch Color of the Color of

WARTED. A pertuer with sufficient money. Patent No. 983.76, whereby an emphaser can open and close his own switch, from the moying pairs, by selecticity. W. F. Sath, Bisbes, Arisona.

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Transfey Re. Scattl.—Wanted, to buy machinery for making sugar of mile. I good by Re. Scipile.—Wanted, to buy a machine for making size steed papears online. Instanty Re. Scipile.—Wanted, to buy a motor driver foot Natura Inquiry No. 6006. -Wanted. a concern shie to on the story makes Developed ones.

Market Story of their Story Self and unpromote.

Market Story of their Self and the story of the st to the same and selection

London's New Ganoliz Omnibus.

Lemdon's New Gesoline elactric Danzilbas.

Is quieter and amoother, control is simpler and easier; while the handliness of the bus in crowded traffic is much greater than with the usual vehicle. So quickly can it be stopped with the powerful braises that, when running at twelve miles an hour, it can be nifecen feet. So the state of the control of th meet the conditions of ordinary stre traffic satisfactorily. Civic authorities a trame saustactorily. Civic authorities are fostering, and in some instances compelling efforts toward quieter and smoother running of mechanically propelled public whiles, and in all directions attempts are being made to perfect an electric combination system, but the "K. P. L." is the first that has been found to meet the severe all. tion system, but the "A. P. L." is the mrat that has been found to meet the severe all-round conditions. The weight of the vehicle in running order lies well within the limit of 3.5 tons established by the

The Scap-nut Tree A Valuable Addition to the Products of American Soil By E. Moulié

By E. Moullé

JY this article Mr. Moullé presents a
l viewes of the visuation and prospects of
the component of the control of which to this country he has well much
of which to this country he has well much
openately these an active part. At the
rums time he makes another ofer to further
the new industry by supplying to persons
erriously interested a quantity of essed out
of his own resources.—Eneron 1.

The original introduction of new tree in the case
its of the country who hought some sects from Chinasourcy, who brought some sects from Chinasource, and the section of the properts of the section of Mr. J. A. Livingstone, of Okla, Pla. A
report was published some time ago by
Mr. Kidder, United States Consul at
Algiers, at the instigation of the writer,
dealing with the economical value of the
soap nut tree. At that time (1903) the Algiers, at the institution of the writer, dealing with the economical value of the soap nut tree. At that time (1903) the value of the solitary seed-bearing soap nut tree in this country was not known to its possessor. To-day he is satisfied that has therein an extremely profitable asset.

possessor. To-day he is satisfied that he has therein an extremely profitable saset.

At the beginning of 1800, after reading the report of the American Consul, the writer imported seeds from lighers such according to the seed of the

GOVERNMENT.

STE UMBFULNESS OF PHE WRIE.

The Front.—Extended experiments carried
sit by the writer and by adestific workers

of comparind antiberty, here descinationed.

A. A. A. Ext. UMBFATT.

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that the fruit (soap nut) and the lemme of the seed furnish the new inspirately for a score of tollet articles of warp assaiderable you mee arrams the appel photoropic far a score of totale articles of vasy-sansiderable commercial value. In the preparation of those products in which the appearances principle is the casential constituent, the hall of the seed supplies the raye material. The kernel contains no seposecous matter, but furnishes a fixed oil which for culinary purposes is equal, and in the estimation of some even superior to olive oil. The oil can also be used for making a soap that will easily compete with the best imported Castile soap. The soap nut has also a sertals, therepeutic-value. Its medichal virtues, according to reliable authorities, see that described:

The soap nut is used internally in cases

described:

The soap nut is used internally in cases of salivation, epilegay, and as an appearant. The seeds, pounded "with watch, are said often to put, as, end to a psecopyan of epilepay, when a small quantity is introduced into the patient's mouth. The fruit is also recommended by native practitioners' for the cure of cibiorosis.

The Leaves and Wood.—The leaves make a good folder, and the cakes from the press after the oil is extracted from the kernel, are reliabed by poultry and all kinds of atock.

The word?

of stock.

The wood is close-grained, takes a good polish, and is admirably adapted for furniture. In color it resembles orange wood. inture. In color it resembles orange wood. Considering that the soap nut tree grows to a height of fifty feet when fully developed, it will be seen that it presents a very well-uable source of timber. In point of fact, however, in the native land of the tree, the wood is not used, the color of the tree, the wood is not used, the color of the tree, the tree, the return from the fruit in it raw state alone being \$10 to \$90 per tree every year. every year.

SOAP MANUFACTURE.

It is no secret to those interested in the Industry of sop manufacture, that to the mount of the soap manufacture, the continued of the soap manufacture owing to the market conditions affecting the price of that material; hence the prediction which the author made when he inaugurated the movement of the soap nut tree industry, at the the that the time would soon come when the soap nut would be in demand for the soap industry. That prediction has come true.

that the time would soon come when the soap nut would be in demand for the soap industry. That prediction has come true much sooner than was expected, as Mr. J. H. Livingstone, of Okla, Fla, has received several inquiries and quotations for the soap nut in carload lots, to say nothing of the inquiries of which the writer has himself been the receipient.

The cost of production of the soap nut is practically nil, once the trees are well stated. The growing of cotton, on the other hand, is expensive and the production has to be restrained to a certain limit in order to preserve the commercial equilibrium between demand and supply over-production of cotton means low prices and concequently heavy losses and discourage—ment to the producers who have been put the control of the control of the production costs practically nothing and in the most unfavorable case the timber of the tree prepents a very substantial source of income to fall back on, in any emergency which might be imagined to arise.

CING QUALITIES.

The efficiency of the soap nut extract as a foam producer, which renders it so wait certain the continuous and the certain of the certain other applications, is discussed in Pare Products, from which some passages may here be quoted: "Saponine extract has various uses, as an addition to toilet soaps and other toilet preparations, for example, and also as foam producing ingredient in carbonated beverages. As compared with Paumes that the certain of the certain certain continuous c

have no currently in curring the market.

"It is said that the song nut is also used by cheughed laundrides-and cidth fulliers in place of song.
"If over the song nut becomes a commercially important product in Florida, the said, where noneassetting is growthed,

will have more or less visionally the oil useds then peanut oil in its general accorning range presentations.

access rum measuration on mass a series access.

I have a great many thousants of seeds which I Intended to use for the oil, but wone sidering the intense interest manifested in favor of the development of the tyee, and realising that a greater good wealth meteralize by the planting of these seeds; I have decided to give them away to applicants who are ownere of land on which the seeds may be planted, and who will consider themelves houre bound to make offer consider themelves houre bound to make offer owner of the seeds are perfectly in the country in which the citras fruit can be valued, excluding Florida, since Florida is already amply provided for Thure see about twenty seeds to the ounce; every applicant can have as many ounces as her or she wishes for one cent an once to cover the peakage it has ced as free, but an extra five cents must be added to over the expesse of a sloth hag, time sud clerk-cal work, as well as the printed directions for planting which are accesspanded with minist write their names and address plainly at the upper left-hand corner of the evelopes and address their application as follows: E. Modil, Jacksonwith, Fig. Order, will be filled at once. Applicants should larry as the season is from now on until May.





struction will be readily understood, and the device can be rigged up by any amatour me obsaic. The Fiference flasks should be wel-secured in place as the power of the machin-in quite considerable.

(12402) G. B. asks: A says that a (12402) G. B. asks: A says title at itself and in the per libour, fired from a riflet, on rear platform of a fine per libour, fired from a rifle, on rear platform of a train or same speed, in opposite direction of motion of train, will drop to ground upon the control of the control of train, will drop to ground. Who is right, and why? A. A. rifle, lail freed from a moving train in a discontinuity of the control of the cont powder, it follows that the half has were on actions and copositis in dispersion; or their rise just balances the other, and as A set has been considered as the pall result seen to fall from their section to the ground of St. initial for first such a many cords a manager. It sightly do not with a given cords and their constant of the constant of th



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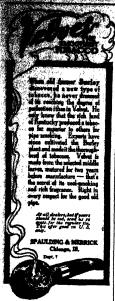
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Solders and Soldering

Mastrie Freight Envise.—The Fort Dodge, Des Moines and Southern Railway has decided to use electric locomotives here-after for the operation of freight trains. The locomotives will each be capable of hauling fifteen to twenty cars.

bauling fifteen to brenty cars.

Tests for lessalating Tapes.—Writing in a recent number of the Electrical World, Mr. William P. Munger calls attenden to the fact that there have not appeared adequate specifications and tests for friction tape. He names six qualities for which standard tests abould be set i. Insulation tape. He names also qualities for which standard tests abould be set i. Insulation to the standard tests abould be set i. Insulation, and the standard tests abould be set in the standard tests abould be set in the standard test and the standard test and the standard tests and the standard test and the standard t 6. Durability.

6. Durability.

Tungaten Lamps in a Factory.—An automobile factory in Detroit has been equipped with fifteen hundred 60-watt tungstan lamps. The factory was not completely equipped when the lamps were installed, and owing to constant jungation, and owing to constantly failing. However, it was found that the resewals required were but 1.5 lamps per day for a period of 75 days. When a file-ment was broken, the lamp was given a slight tup so at to set the filament swigning, and this would ordinarily result in lamp with as the color of the days the same of the color of the c

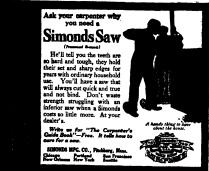
saved in this way.

Fire Extinguisher for Heetrical Apparatus.—The problem of sighting fires in and about electrical apparatus is a serious one owing to the fact that the water, it was not some owing conceived a better material to put out incipient series of the metal parts to put out incipient series of the metal parts in an extinguisher that is "Moneometro" and one that will not attack metals or insulating materials. Recently the production of carbon tetrachioride has been rendered comparatively inexpensive. The liquid is very volatile and its vapor is an excellent fire extinguisher. Furthermore, it does not attack the conductors or insulating materials ased in electrical apparatus. ing materials used in electrical apparatus.

Electrification vs. Smoke in Chicago.—
An investigation has recently been made of locomotive smoke in Chicago in order to determine what share of the smoke in the city possessive smoke in Chicago in order to de-termine what share of the smoke in the city comes from this source, and to show that by eliminating steam locomotives, there will be a decided abstement of the smoke missner. Mr. Paul P. Bird, the city smoke inspector, be collected some very startling statistics, collected some very startling statistics, collected some very startling statistics, and the coal showled into the fire-box of a locomotive issues from the stack in smoke and cinders, that rallroads con-tribute 43 per cent of the total smoke in the city, power plants 30 per cent, and special plants 18½ per cent, while the smoke from business buildings and dwell-ings, and from boots, smounts to but 14½, per cent.

per cent.

Feed-proof Devices.—In order to make his storage battery absolutely fool-proof, Mr. Thomas Edison deviced a machine for abusing the battery in every known way, but although he is one of our most brilliant inventors, Mr. Edison had to admit that when it came to inventing methods of abusing electrical apparatus, he could not complete with the "fool" operator. Try as completed to the property of the pro





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How do you like the Scientific American!

In problem of editing the Scientific American is more difficult than the thousands of readers who seceive it every week stage, realize. In presenting the scientific and industrial news of the day accurately and interestingly, it goes without saying that discriptionation must be used. Is this invention or that discovery of sufficient importance to find a place in a periodical which is intended primarily few business men, inventors, doctors, lawyers, and a host of professional men, men of broad views and intelligence, men who want to be kept abreast of the scientific times? Or is it simply a little ripple on the great ocean of human thought, consolving that we can ignore? Or is it so curious that it will interest a host of readers by its sheer novelty rather than its scientific value? Over and over again these questions must be answered during the year.

¶ Of course, the editor is a human being and has his likes and dislikes. Perhaps battleships, flying machines, radium, and the everlasting stars interest him so much as a man that unconsciously he has permitted his editorial self to drift away from the standards which some readers would have him follow. If so, he would like to receive well-meaning letters that show how readers of the Scientific American regard the periodical.

Q Why not tell the editor what you think of the Scientific American? Tear the paper to pieces if you like. Begin with any issue, with the year 1845, when it was first started, if you care to, and wind up with the last number. Show us where we have succeeded in pleasing you and where we have failed. Tell us something about your tastes, something about your calking in life, and why it is that certain articles interest you more than others. If there is anything in the pages of the Scientific American that seems too deep for a layman, too technical in a word, although the subject itself may appeal to you, tell us so. If there are some subjects which have been discussed too often or too little, tell us what they are.

¶ What do you think of transferring the weekly list of patents granted, to the columns of the Scientific American Supplement? Is or is not the reading matter now printed in its place of more interest and value to you?

In order to show you how much space the Scientific American has been devoting to science, industry, mechanics and engineering in the past year, we publish here an editorial chart which will help you, a chart which will show you at a glance how many columns have been devoted in the year to steam engineering, to physics, to naval affairs, to meteorology, to bridges, to astronomy and aeronautica. We compiled this chart to help ourselves, and now that we have done so we feel that it may help you as well.

Jones 1	D ATE		Aeronautics	Asriculture	Archaeolosy	Astronomy	Automobiles	Biography	Boost B	Botany	Bridges & Canals	Building Construction	Chemistry	Civil Engineering	Correspondence	Electricity	Exploration 9 Travel	Fuels	Gas Engines	Irrigation	Mechanical Engineering	Manufacturing	Mechanics	Medical	Meteorology	Mining e Metalliar qu	Miscellaneous	Matural History	Ordinance Almor	Photography	Physics	Railways	Sanitary Science	Same	Steam Ensineering	Subways of unnels	Notes & Queries	Books	
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4 After all, every periodical is the product of its readers as much as of its editors. It is the letters that we receive in the morning's mail, the little straws that show which way the wind is blowing, that guide us as much as our own thoughts, in publishing this journal. The more expressions of opinion that we receive the better able are we to perform our task.

4 Sit down and write!

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Mammoth Whistles for a Mammoth Ship.—The steam whistles for the "Olympic," the largest ever mafe, consist of three bell domes \$9, 13, and 18 inches in diameter, with a maximum height of 4 feet \$9/2 inches. One set will be carried on the forward funnel and another on the second forward funnel.

forward funnet.

Catabill Aqueduct Tunnel.—The Board of Water Supply in New York etty will shortly let a contract for constructing a large syphon tunnel beneath the Hudson River at Storm King to carry the water supply to the eastern side of the river. Borriags indicate that to reach a sufficiently firm unfassured rock, the tunnel unit be avoided by a doubt of the contract them. carried to a depth of over one the feet below the surface of the river.

feet below the surface of the river.

Queboc Bridge Experts. —The Queboc Bridge Board has developed serious differences of polinon as to the merits of the plans submitted in response to its call for idea. To assist in reaching a conclusion, the Canadian authorities have appointed as additional experts Mr. Henry W. Hodge, additional experts Mr. Henry W. Hodge, and the submitted Bright of New York city, and Canadian authorities have appointed as additional experts Mr. Henry W. Hodge, and D. Domillon I. Turn and Steel Campany, of Sydney, Nova Scotia.

Proposed Ocean Terminal at Montauk Proposed Ocean Terminal at Montauk.— The recent purchase by the Long Island Rallroad of one and a half miles of water front at Montauk Point, at the easterly end of Long Island, seems to give point to the many rumors that the Penneylvania Rallroad Company proposes to build a stemming the Penneylvania Rallroad Company proposes to build a stemming the propose to large. Should seeming the propose hours' rallroad run would place the passen-gers in the heart of Manhattan Island, with a saving in time of five or six hours. New York Sulway Traffic.—As reported

with a saving in time of five or six hours. New York Subway Traffic.—As reported to the Public Service Commission, the sale of tickets shows that in 1910 the New York subway carried 270,391,400 passengers. In 1900, the first year of operation, its sales were considerably less than one-half of this, amounting to 115,200,313. Last year, the largest sales, 16,880,088, were made at the Brooklyn Bridge station. The Borough Hall, Brooklyn, asles were 18,900,319. The Grand Central station and Pulton Street. Manhattan, sold each over 18,000,000, tickets, Fourthenth Street, over 11,000,000.

We Must Fortify the Panama Canal We Must Fortify the Panama Canal.—
Of all the arguments for fortifying the Panama Canal, the most potent is that recently presented by President Tark, when he drew attention to the fact that a very considerable proportion of the motions of the world have not yet progressed to the point where they have at all times stable, reliable and responsible governments. Incidentally, we might mention that the two might mention that the two might mention that the two many times are the bands of mutineers in the new yor a South American republic. One of those ships, regardless of international agreements as to neutralization, could easily have destroyed the finished canal.

Railroad Academta in the United Braten.—The Interstate Commerce Commission Accident Bulletin, covering the three months ending September 30th, 1910, gives the number of persons killed in train accidents during that period as 321, and the number injured as 3,399. Other accidents during how the second to the commerce of the second to the the number injured as 3,382. Other ac-cidents, such as those to employees, to passengers getting on or off cars, acci-dents at grade creasing, to trepassers on the tracks, etc., bring the total up to 3,948 killed and 1,930 injured. This is at the rate of nearly 9,0000 casualties a year. On the other hand, literiman's system or ratio the other hand, literiman's system or ratio ried 30 million passengers in 1010 without a fatality. This, we pressum, relates to train accidents, pure and simple.

a intuity. Ins. se presume that accidents, pure and singular train accidents, pure and singular train accidents. Professors Lucke and Central Station.—Professors Lucke and Central Station.—Professors Lucke and England and Central Professors and Central Professors and Central Professors and bow out the northerty walls might easily have been developed by a gas explosion. A mixture of Plusteb gas with air is explosive within a gas percentage range of a to 13 per cent, and it develops range of the professors. An arrange of the control of the second control of the second

Market Market

Modern French Time.—For more than a quarter of a century an effort has been made to do away with the difficulties caused by referring time to two meridians—Greenwich and London. France has decided to wich and London. France has decided to adopt the Greenwich meridian hereafter The Greenwich meridian is the one gener-ally used in astronomical calculations.

ally used in astronomical calculations.

Natural and Artificial Vichy,—Natural Vichy water always contains sailts of lithium which are not present in artificial vichy. The spectrum of lithium is characterised by a bright red line. Hence the graulmeness of a specimen of water sold avichy can be proved or disposed by exappearing a few fluid ounces of water to dryness, beating the solid residue to include the same with a spectroscope. If the red line characteristic of inhum does not appear, the water is artifial.

The Recent Ricction in the Academie des

appear, the water is a criffial.

The Record Election in the Academic des
Sciences, —There was a considerable stir
among academic etrels in Paris owing to
the fact that both Prof. Edouard Branty
and Mine. Curie were candidates for the
vacant seat in the Académic des Sciences.
A complication by in the proposition of admitting women as members of the Academy,
lence there was a prolonged discussion
upon this point. As both the candidates
worth, each hold many partisans. At the
clection, Prof. Branty received 30 sotes
and Mine, Carle 38, so that Prof. Branty
was thus elected.

A Recently Discovered Variable Star.—

A Recently Discovered Variable Star.— M. Deslandres, a well known French as-tronomer and chief of the Meudon observatransmer and shief of the Meudon disserva-tory, briggs out some new points about a variable star. In the constellation of the Lisard. This star, which was discovered; about a year ago, seemed at first to be of the 13th or 13th magnitude. Its brightness suddenly increased, and during last No-vember it reached the 3th magnitude. Less than a mouth after, its brilliancy lessened, and now the star is only of the 7th mag-nitude. As is the rows for nearly all other properties in the star is only of the pro-teristic spectrum, in which, the hadrogen lines are extremely strong.

Mirates in Antarctic Water Specimens.—At a recent meeting of the Academic des Sciences, M. Minta treated of rain water and snow which were collected by the Charcot antarctic expedition and brought to Paris by Ensign Conferences, M. Minta found that rain and snow of the antarctic regions contain as large a proportion of nitrates as those of temperate sones, in apic of the absence of nutrates fanting in the six are formed by electric discharges, we may conclude that such nitrates are brought to the south polar regions by north winds from the equatorial regions, knowing that nitrideation is intense in these latter.

Dahlies and Potatons. By a kind of Nitrates in Antarctic Water Sp

tion is intense in these latter.

Dahlias and Potatoes. By a kind of horticultural irony the dahlia, that popular flower that so often forms a conspicuous display at flower shows, he as decedification of the second section of the second section to the second section to the second section to the second section to the sec double damin and other department fantasies. The tubers of the dahlis acrid for most tastes, are still eaten in parts of France. The tubers of the dablis, to-

The Shapes of Eggs.--There was recently had before the Zoological Society of Lon-don a mathematical discussion of the difdon a mathematical discussion of the dif-ferences in the shapes of eggs. A few eggs, like those of the owl and the tortoise, are spherical, or nearly so; a few, like the grebe's or the cormorants, are ellip-tical, with symmetrical endag the great ma-jority, like the ben's, are ovoid, or blunter at one end than the other. The hen's egg is always laid blunt end foremost. Eggs

is always laid blunt end foremost. Regat that are the most unsymmetrical are also aggs of large size relatively to the parent bird. The yolks of eggs are spherical, whatever the form of the entire egg may be. This has been shown to be due to their being enclosed in a fluid, the "white," which makes the pressure everywhere on the sur-face of the yolk practically constant.



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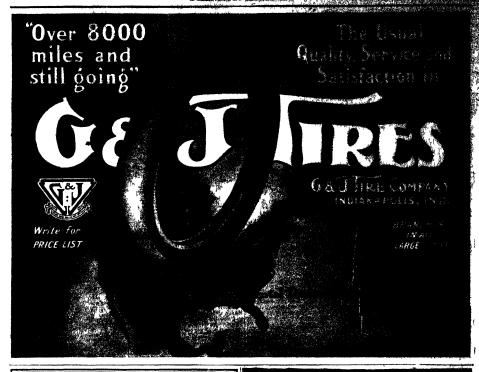
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American School of Corre	spendence, Chicago, U.S.A.
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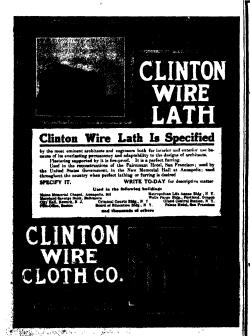
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Some truths peculiar to the





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What name springs instantaneously to your lips when the best cars are under discussion?

The Cadillac, intuitively.

Other good cars you admire and mention—but the Cadillac invariably comes first to your mind.

And not alone to yours, but to thousands of other minds—to men in every State of the Union, in the city and on the farm.

That is one of the things which is peculiarly true of the Cadillac.

Another—which should have equal weight with every man considering a car—is the astonishing steadiness of the Cadillac sales.

For nearly three years now—or ever since the present models were first offered—that demand has not lapsed or lessened for a single day.

It has never been necessary, in other words, to check or curtail any output planned by the Cadillac company—a circumstance unprecedented and peculiar.

No fickleness in popular favor; no economic condition; no seasonal setback to the industry, has ever disturbed the semand for its maximum capacity.

In substantiation of this statement it is merely necessary to point out that during the last quarter of the year 1910, notwithstanding a temporary quictness in business in general, the votume of Catillac nodes exceeded any province quarter in the history of this company. But what is more significant, that solame we believe to have been more than fifty per cent greater than that of any other motor car manufacturer.

Cadillac sales are fixed, staple, steady; greater in some months than in others, of course, but as certain in their totality as the days of the year.

Consider the reputations that have come and gone; waxed and waned; expanded and contracted—and sak yourself: what central potent fact it is that moves so many thousands to be of one mind in regard to the Cadillac car.

The answer is no doubt as ready to the tip of your tongue as it is to ours.

Cadillac pre-eminence is not attributable to some single or even several special features. That pre-eminence is due to the "goodness" of the car as a whole; from its splendid motor down to the last screw incorporated in its make-up.

The Cadillac has made the technical term "standardization" a familiar and homely phrase in thousands of homes, which had its significance first explained to them in a description of Cadillac construction.

It is this "standardization" to which is attributable in large measure the many virtues of the Cadillac car: the harmonious workings of its parts, the smoothness of its operation, the almost vibrationless action, the economy of maintenance, the durability and the bull dog persistency in "making good" even in spite of abuse.

England crowned this car with its most honorable trophy for possessing a degree of standardisation unknown outside of the Cadillec.

These are some of the reasons why you and hundreds of thousands of others unconsciously say "Cadillac" first.

Because the Cadillac is a good car, through and through.

SPECIFICATIONS IN BRIEF.

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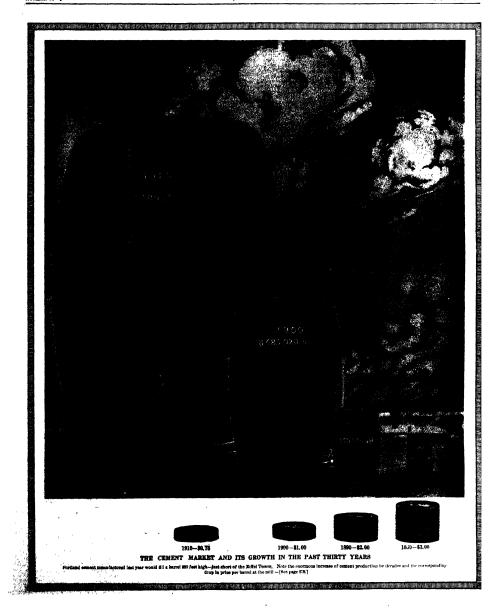
SCIENTIFICAMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

WOLDING CIV.

NEW YORK, MARCH 18, 1911

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SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, MARCH 18, 1911

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The foliator is always gird to receive for examination illustrated articles on subjects of function indicated. If the photographs are start, the carticles down and the facts authoritie, the contributions illustrated as peculiar space at attention. Accepted articles will be paid for at regular space ratios.

The purpose of this journal is to record accurately n simple terms, the world's progress in scientific dedge and industrial achievement. It seeks to knowleda present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fuscination of science.

The Cement Era

T seems to be generally agreed, and we think with much reason, that the year 1911 should mark with much reason, that the year 101, should the centenary of cement, or, to speak more strictly, of Portland cement. This selection is due to the et that Joseph Apsdin was born in 1811, and tact that Joseph Apodin was born in 1811, and that it is to his intelligence and pattenee that we owe our modern hydraulic cement. History fails to establish the exact date of the first production and use of this great modern material of construc-tion, for it is a fact that Apodin who was a brick maker in Lecky, Yorkshire, spent a dozen years or more in experimental work before he covered his invention with a noted. meaning work better he covered his invention with a patient, and nearly three times that period elapsed before his discovery received its adequate recognition. Incidentally, it may be mentioned that the inventor gave to the new cement the name of Portland, because it resembled a build ing stone very widely used in England, which ing solar very warry used in Engana, which is ob-tained from the limestone quarries at the lslc of Portland, in Dorsetshire. The "isle," by the way, is not an island, but a rocky pennisula, extending into the English Channel and connected to the

mainland by a long, curving beach.

It has long been the habit of the historian when speaking of the constructional or mechanical side of human progress to name its various cras after the predominant materials of construction. Hence, in their succession, we have had the eras of stone, bronze, iron, and steel. To-day we find ourselves well launched in what may justly be called the era

Let it be clearly understood, just here, that cement is many centuries older than Joseph Apsdin's Portland cement. Long before the Christian era the Egyptian and the Roman builders were familiar with a form of concrete, compounded from certain natural lines, clays, and rocks (generally volcanic) or gravel. Those wonderful engineer-architects, the Romans, laid it freely in the foundations of their temples, and did not he state to make bold use of it, both in dome and arch. The concrete of the ancients, however, was of a slowly-setting nature, requiring considerable time to reach the great hardness, which characterizes such of it as still survives.

The valuable quality of Apsdm's invention lay in se fact that he produced a mechanical mixture which, when treated with the proper amount of water, will harden in a short space of time, either in air or under water, and although his discovery not receive its due recognition until the middle of the nineteenth century, this wonderful method of making an artificial stone, compounded of simple, obtainable and cheap ingredients, was clearly set forth. Subsequently, the coment industry awaited the development of another great indus-trial art, that of steel making, which was destined place it in its present position as the greatest of the world's constructive materials for works of

or all uses to which ordinary masonry can be put, cement, when mixed in the proper proportions with sand and broken stone or gravel, forms an ad-

mirable and, if properly finished, a not unsightly building material. But like any other system of masonry construction, while it is capable of enduring heavy strains of a compressive nature, it is illadapted for those of tension. Hence concrete necessarily has a very limited range of use in structures in which heavy tensional and bending stresses will in which neavy tensions and tensing stress. Occur, as, for instance, in beams or girders, in arches of flat span subjected to uneven loading, or in posts or columns where structural requirements call for a small ratio of diameter to length.

About the time that concrete was beginning to receive its due recognition, the great Bessemer, by inventing his process of decarburization, so far im proved the quality and reduced the cost of steel, that it quickly replaced iron and introduced that won-derful commercial steel, which has been the most potent factor in the marvellous industrial development of the past half century.

It was about fifteen years ago that serious attempts were made to combine steel and concrete by molding the one into the other in such a way that the resulting product would possess a high resistance not merely to compressive but to bending and tensional stresses. The first practical experiments in this direction gave such good results that the attention of engineers throughout the world was quick-market and the statement of tention of engineers throughout the world was quies-ly centered upon the problem. A vast amount of experimental work was done, out of which has sprung our modern reinforced concrete, regarding which it is not too much to say that it is destined to play a part in engineering construction, second only, if not equal, to that of mild steel. The deonly, if not equal, to that of mild steel. The developments of the past fifteen years, particularly of the last five, have been truly phenomenal. Not only to concrete found to be available for practically every form of construction which hitherto has been built in brick or stone, not only has it proved well adapted for many uses in which neither brick nor stone is conveniently available, but it has now invaded the field which was supposed to be pecul reserved for iron and steel, as witness the fact that it is being used for piling, for tanks, for trussed bridges, for framed roofs, and for flooring of wide span. Most significant and interedible of all, it is taking the place of steel in the construction of certain types of boats and small barges and ships. In works of great magnitude involving a large amount of construction, it has proved to be simply invaluable; and it can truly be said that were not concrete and reinforced concrete available, that most monumental of all modern engineering works, the Panama Canal, could never have been under-taken by the United States.

It will be admitted, then, that the present issue

of the Scientific American, that the present issue which is devoted to the subject of Portland cement, as particularly timely, both because of the vast advances which are being made in the application of this material, and because of the fact that the present year is the centenary of the birth of its original inventor. In the selection of the subjects in the inventor. In the selection of the subjects in the various chapters, we have simed to give a clear and consecutive account of this material, tracing its history from the ancient cement compounded of natural materials, down to the Portland cement of modern

It is a rather curious fact that while Portland cement enters so largely into our modern life, there are few people outside of those connected with it and constructive use who know just exactly what Portland cement is. The question is answered in an article which takes the reader, step by step, through an up-to-date eement factory. Of no little interest will be the article showing how the price of cement has fallen steadily as its use has become more extended. Every prospective builder of a home must be more or less concerned in the subject home must be more or less concerned in the subject of the mondithe cement house, and he will find in this issue a description of this original method of house building by pumping the misture into special forms. For those who may have a prejudice against concrete as a material for house building, on the ground of its liability to dampness, the article by an expert in waterproofing materials will have par-ticular value, and, again, for those who may object to cement on the ground of its color, to say nothing of its discoloration, the article on the artificial coloring of cement and the admirable results to be ob tained in reproducing the natural stone effects, will be entertaining, if not convincing. The larger side of the subject, as applied to works of magnitude, is treated in an article on the Panama Canal, in which treated in an article on the ranama Canal, in which the methods adopted in gathering the 5,000,000 cube yards of rock, sand, and cement together, mixing them, and building them in place, are described with the aid of a series of the latest photographs pub-lained by the courtesy of the Isthmian Canal Com-

The Scientific American in the Con Parliament

THE Hon. George P. Gruhass, Minister of Canadian Railways, during a recent discussion in the House of Commons of the subject of the Quebec bridge, in referring to certain criticisms, made by this journal, of the government's design for the new structure, referred to the Scinn-viric American as being of the "knocking" variety.

Now, although the Scientific variety. Now, although the Scientific variety wide field, we have to admit that among the variety of subjects which come up for editorial analysis and discussion, that of slang is happily, or, as in the present case, unhappily, not included. We say, unhappily, for if we were expert in the re-finements and delicately shaded graduations of the slang dictionary, we might have a clearer knowledge than we possess of just what was in the Hon.

edge than we possess of just what was in the Hon.

Mr. Graham's mind when he spoke of this scientific
journal as being of the "knocking" variety.

In the absence of any definite information, we
have concluded that our criticisms, technical and
otherwise, of the government design for the Quebec
bridge, do not find favor in the eyes of the Hon.

Mr. Graham, nor of his chief engineer, upon whose
shoulders, we understand, the responsibility for the
design must be placed. design must be placed.

we were to venture on a definition of a "knocker," we would describe him as one who has fallen into a chronic attitude of destructive criticism; one into a chronic attitude of destructive criticism; one whose fault-fauling in prompted by a certain twisted mental attitude, which takes but small account of the merits of the question involved. Now, as a mat-ter of fact, the attitude of this journal to great public works, has invariably been one of generous appreciation. At the same time, however great the work might be, however distinguished the names that were back of it, we have never hesitated, when occasion called for it, to criticise with freedom and,

as in the present case, with severity.

Thus, in the case of the Quebec bridge, we printed in our issue of February 18th, 1910, a plan and a description of the design which had been drawn up by the Quebec bridge board for the new structure. We took exception to the design on the ground that it was not only of inferior merit, considered from the bridge engineer's standpoint, but that, if constructed, it would be the ugliest bridge of monuconstructed, it would be the ugliest bridge of monu-mental proportion among those hitherto proposed or built. "It presents," we said, "the appearance of a monotonous mesh of triangles and straight lines. From abutment to abutment, there is not one graceful line in the whole structure; not the slight-est attempt to combine the beautiful with the use-ful. The faulty structure which collapsed had at ful. The faulty structure which collapsed had at least the redocming feature, that the outlines were structurally and aesthetically correct; and, although structurally and aesthetically correct; and, although the Forth bridge has been made the subject of much criticism by the artist and the architect, it must be regarded as having distinct claim to beauty, when compared, as on the accompanying page, with the new plans for the Quebee bridge."

That was our attitude on February 12th, 1910, and the events of the past twelve months have produced nothing that would lead us to change our opinion. Furthermore, the dissatisfaction which we expressed with the plans of the Quebec Bridge expressed with the plans of the Quebec Bridge Board, and which, in the Hon. George P. Graham's mind, is technically defined as "knocking," seems now to be shared by the expert board which has recently passed upon the design in question; for, at a recent ballet, four votes were cast against it and but one, that of the cagineer chiefly responsible for the mechanical was again in its favour-achieves. of this action being that this gentleman has resigned.

Since this matter of the attitude of the Scientific

of this action being that this gentleman has resigned. Since this matter of the attitude of the Schentry: American to this great engineering work has been called in question by a member of the Canadian government speaking in the House of Commons, we feel impelled to state, once and for all, that our attitude in this matter is one of disinterested friendliness. Our great neighbor to the north is about to undertake the re-construction of a bridge which, upon its completion, will rank as the most menumental work of its kind in the world. Apart from its economic value as forming a great link in the means of communication between Canada and the United States, the Quebec bridge will, or at least should, stand as a monument to the enterprise and engineering skill of the Canadian people. The Scientryze American orticised the government's design on the ground that it would fail in these very regards. We believe that plans can be drawn, upon which a noble bridge can be thrown across the St. Lawrence rives at Quebec, which will be lighter, more secure, possess greater dignity and beauty, and be erected for far less cost than the very ordes and clumsy design that has recently been voted deem by

Jacobus Henricus van't Hoff

Founder of Stereochemistry and of the Modern Theory of Solution

FOUNDET OF Ster.

TOR the second time, while the year is still young, the world of science mourns the loss of a great leader, and the state of the s

possinity vatue man any uncanness or minus, since to does not understand Lattinered the Polyvelunitum at Delft, where he completed the regular three years course in two. He then proceeded to the University of Leyden, to which he was admitted without examination by apecial inhi-isterial permit. He subsequently studied under the great Keakle at Bonn and under Würts at Parls. In 1874 he received his doctor's degree at Utrecht, where he also began his teaching activities in 1875. Only a year later he was called to Anateriom, to be shortly after print the appointment at Berlin which he retained to the early of his active life.

the appointment at Berlin which he remaind to the end of his active life.

The work of Van't Hoff is distinguished, not so much by great volume, as by the extraordinary force and originality of his conceptions to the principles in the contract of the principles.

so much by great volume, as by the extraordinary force and originality of his conceptions and the supreme importance of the principles which he brought to light and enunciated.

His first great achievement lav in the field of organic chemistry. To properly appreciate it, we much carry our minds back to the year 1974, and recall some of the circumstances that prepared the why for Van't Hoff's confugration of the property of the on paper, and therefore necessarily in two dimensions only, in some respects fails to represent observed facts. Thus, if we write out graphically the formula for dichior-methane it appears that there should be two isomeric

In point of fact there is only one such body. Thus the representation in plane formulae in such a case would indicate a greater variety of forms than actually exist. In other instances the reverse is the case to a plane freeding of the control of

principle was recognized and published in the very same year, 1874, by the French chemist Le Bel, working quite independently. Far-reaching as the influence of van't Hoff's concep-

independency.

Far-reaching as the influence of van't Hof's concerpFar-reaching in the development of organic chemistry,
one hardly heitster to say that of still more fauntmental importance are his contributions to physical
chemistry. To him is due much of the credit of the
detailled working out of the results which those from the
law of mass action. By him the application of thermodynamics to physical chemistry, but applied to isolated
cases by Horstmann, was greatly extended, so as to
bright to light among other things the influence of temperature upon chemical equilibrium. The result is experature approached equilibrium. The result is experature to the control of the control of the control

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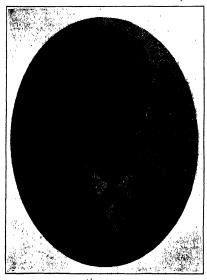
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that is the co later by Braun.
Perhaps most important of all is van't Hoff's contri-



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numerous chemical rearrians. In which we are treinically or otherwise interested take place in solution.

For this resion alone the clearing of the view by a
thoroughly satisfactory theory of solution represents an
immeasurable gain to science, pure and applied. To
fully realize the almost unparalleled significance of
vant Hoffs, elucidation of the laws of solution, we must
bear in nind that these form at the same time the foundation for the modern theory of electrolysis and ionic
dissociation. The limitiess field of electro-chemistry, with
its remarkable practical applications, is intuitately conThe law of solutions, as developed by vanit Hoff, is
striking and beautiful in its simplicity the sometic presure of a dissolved substance is equal to the gazeous
pressure which that substance would exert of occupying
the given volume at the given temperature, but in the
form of a gas. The law is of course only approximate,
holding only for dilute solutions; in the case of electrolytes allowance must also be made for dissociation.

Following out naturally the trend of his work, varil
Hoff next (1888) broached the field of "solid solutions,"
which has proved of much importance in connection with
the metallography of steel "The
characteristic world."

Hoff mext (1888) broached the field of "solid solutions,"
show the metallography of steel "The
characteristic world."

This subject of his host great series of investigations, carried out in cellaboration with Meyerhoffer and
others. This subject is of special interest in connection
with the phenomena presented in the evaporation of sea water and the formation of deposits, such as the famous
sait strate at Stassfurt, in past geological epochs. By

a systemate study at the conditions under which different softs are laid along from solution. It is possible to establish a kind of "geological horizonters", which gives us a clue as to the tougher-turner solution from plot at the time the deposits serie formed. There are establishes of a temperature as high as 70 deg. C. hasing been reached at Stansturt.

Such in brief recless, are some of the bequests which will be a fine to the solution of the solution of

The Advance of Plant Life

The Advance of Plant Life

Willen, years ago, there occurred the tremendous volcame explosion in the Straits of Sunda, "the liggest mose the world ever heard," half of the Island of Krikaton was blown awa, and every vestige of Illewas destrored on the remaining half. The ground was laired under bot index and burning paniles stone, varying in dept.

Vestable germ could possibly have surreview to the catastrophe. Yet, only three versa after the cruption, when Krakatoa was explored, various species of plants were found flourishing there.

It was shown that they could not have been carried there by human agency, because menhad not visited the devastated island. The character of the new plants was such as to prove that they could not have been derived from the former vegetation of Krakatoa, even if any living remains of that vegetation could have existed in the burned and buried soil.

The nearest lead on which any plants grew

have existed in the burned and buried soil.
The meries than of which any plants grew
was the Island of Sidean. Sumatra is twently
miles and Java (wently-one miles from Krakaton. Yet a dozen kinds of ferms and several species of thosering plants and grasseswere discovered by Treut financialing on the
shore and in the mountainous interior. That
some and the first many the second of the country
of these forms of september and been
merit these forms of september and the forfact that seeds of littorial plants were
found scattered on the shore.

As to the other plants, the instore of their

rac fact that seeds of littoral plants were found scattered on the shore of the found scattered on the shore of their conditions. First, a thin thin of a vingle form as follows: First, a thin thin of a vingle form in the atmosphere, converd the pumies atone and, through chemical action, brought its surface into a condition fitted for the nonrishment of ferns and later of flowering plants. The seeds of these were brought by the winds and birds and, as soon as the soil was capable of supporting them, they took read and, bathed induling the barren Island Figure 1 and 1 and

birds When man comes to her assistance, the work goes on apace

Of more than eight, specus of plants inhibiting the Laccaduse Islands, which are almply the tops of a group of submerged mountain peaks in the Arabian Sea, half of whose modulants have been, at times, weept off by storm who there is the believed that fifty-six have been introduced by man, elven by the sea, two by the winds, and two by birds.

There is inthose more.

There is nothing more impressive in modern science than the story of what has been learned of the gradual conquest of the earth by plants.

The Color of Flowers

The Color of Flowers

THE colors of flowers have been frequently studied from the chemical point of view as well as from the busingeral—that is, in relation to the adjustment of plauts to their surroundings. But very little has be refore been done with the physical problems headed. A recent flowers being out the fact that the buildings and of the fact that the buildings and flowers being out the fact that the building appearance of many flowers is due not to the character of the papient, in the cells of the petals, but to the presence of air spaces between the cells in the deeper laters, these inclosed air bubbles reflect from their surfaces in such manner as to give the belliant appearance. The great variety of colors among flowers is produced by a comparatively small number of pigments. The explanation for this lies in the fact that a few inguistred by a formation of the complementary pigments, one of solar laborate the light regard in a smallar number great tones and browns are produced. The shape of the epidermal or shar cells is also found to modify the effect by modifying the refraction and the reflection of light.

The Making of an Aeroplane Propeller

How One of the Most Successful French Screws is Constructed

A LMOST all aeroplane propellers are made of wood, A whoch is preferred to steel for several reasons. A skeel hide is liable to map audedly and without warning under the influence of changes of temperature or violent shocks. A wooden blade, if mudfeenly strong, is less liable to break and gives warning of impending fracture by hending and splitting.

Wooden propellers are also much lighter than steel propellers. The blade of an aerial propeller has sharp edges, but is quite thick along its median line. It is made thick, not merely to strengthen it, but because thickness offers the same aerodynamical advantage in the propeller that it presents in the sustaining planes of the aero-peller that it presents in the sustaining planes of the aero-

ness offers. The same aerodynamical advantage in the pro-peller that if presents in the sustaining planes of the aero-plane. This thickness gives sufficient strength when the material is wood, while if would make a steel propeller unnecessarily strong and excessively heavy. Wood is also nucle causer to work than steel.

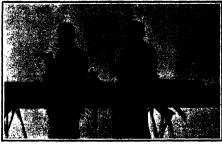
The Chautiere propellers, which are employed is a large majority of all secoplases, are built up of several planks of well seasoned ash. These planks are cut to the shapes of a number of sectiona transverse to the sais of a propeller designed in accordance with the special osseditions proposed, in regard to number of revolutions, torque, tractive effort and speed of the sevoplane. Back plank forms part of both blades of the two-bladed propeller (the usual type) and therefore a hole is cut in its middle part to receive the hub. The planks are then glued together by their faces, after laving been accurated to the two-bladed propeller sprondensies of the succession of the fluided propeller approduction of the fluided propeller approduction of the succession of the subsection of the superfluous wood between these lines and working the entire surface to the required form. This is a delicate task, requiring great skill and care, for

the removal of the country malerial at any point is rain the swork. The surface is finished by pollulage A still more dedicate operation in now sequence is to halance the two hadees, as even a slight different length, weight or shape might cause dangerous vitou in a wapidly revolving propellor. The project important of an amender, which is pointed on very on frietien wheels in a specially devised machine, as blades are carefully retouched until the propellor mains in equilibrium in every position. The propellor is considered to the safet country in the propellor is fromly attached to the safe classipping its central portion between two stud disks, nected by bolts which pass through the wood.

The accompanying photographs illustrate several s in the making of an exceptane propellor.

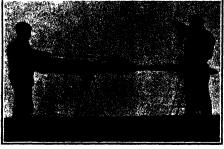


Marking center on plank



ATTLE STANFARD FOR THE STANFARD STANFARD STANFARD STANFARD STANFARD STANFARD STANFARD STANFARD STANFARD STANFA





THE MAKING OF AN AEROPLANE PROPELLER

Wireless Telegraphy and the Zeppelins

THE most interesting recent development in the tech-

THIE most interesting recent development in the technology of acronautics is the application of wireless telegraphy to various types of surships. The subject is telegraphy to various types of surships. The subject is described engineer Richard Tann, with special reference to the rigid or Expeptin type of duripide.

He says: The rigidity of the Zeppelin balloons is achieved, as is well known, he along and complicated framework of aluminum. It is only too easy for these mage masses of metal to collect from the atmosphere quantities of electricity, whose discharge not only causes very serious disturbances of the wireless system, but may be the direct cause of a catastrophe to the halloon. Indeed, the destruction of the "X, IV" is entirely explicable as a result of such archine.

a result of such action on the "\(\), \(\) \" is a cuttrely explicable as a result of such action that on the landing of the "\(\), \(\) \" is a clearly equilibrium was established by means of the branches of the tree, the resulting spark both acting fire to the gas and fusing the aluminium rods. Only fifteen accounds would be required for the complete consumption of the gas and twenty seconds for the destruction of the envelope. Measurements were unde, in fact, which led to the astonishing conclusion that a potential difference excluded of about 100,000 volts, which millimeters. (Air being ordinarily a good insulator, it is estimated that, except for great distances, a tension of 1,000 volts will bridge a gap of one millimeter.) In view of these considerations the Zeppelio dirighlie as at page-ent constructed is obviously unfitted to carry a

wireless installation, and may be said, indeed, to carry within itself the seeds of its own destruction.

On the other hand, its general efficiency has been too brilliantly demonstrated for it to be abundoned, in spite of the appalling disasters of which it has been the richin. Consequently determined efforts have been made to so modify it as to adapt it to the carrying of a wireless system and to get rid of its inherent perfix.

Both these ends may be accomplished by the use of a mon-conducting material, not as swood, for the construction of the framework. Wood, of course, in not an ideal attacked to the second of the real state of the mon-conducting material, not as wood, for the construction of the framework. Wood, of course, in not an ideal atmospheric influences. But recent experiments indicate the feasibility of its employment and its superiority to metal. In fact, a new model of the right dirightle has just been built at Lans upon the plans and specifications of Prof. Schutte. He makes use of extremely light wooden tubes of ash and popilar, and his dirightle has an even greater capacity than the 1a,900 cubic meters of the 7eppelins.

This improved and asfer atrabip will soon receive a practical test of its superiority, since it is to be supplyed for the ballone expedition to the North 20th anatorially increase the prospects of the expedition for success. The wireless installation which it can agify carry is not only a safeguard to the crew it sees of accident, but will peeml of constant news of the results of the expedition being forwarded to the proper soltonti-ties. Thus, event if disaster and death eventually sweed to the wood of the expedition being forwarded to the proper soltonti-ties. Thus, event if disaster and death eventually sweed to the sealest of the expedition being forwarded to the proper soltonties.

In order to protect the wooden tubes as much as pos-sible from the effects of dampness, they will be imprey nated according to a certain formula. Thus Prof. Schuette hopes to avoid both disturbance of the wireless rystem and the dangers due to the accumulation of heavy charges of atmospheric electricity.

Sewer Water and Table Vegetable

Sower Water and Table Vegetables

D ZEARACHES have been sade by Mears. Renlinger
and Novi, of Paris, as to the effect of ever vater
upon registion. It was previously shown that bacteria
or plants, and on this account the Hygene Council of
France prodicted the cultivation of certain plants on
the fields of accessed theore in lateralization; including regutables and fruity which grow close to the ground and are
cents in the rew state, such as water cross, latitude, colory,
colors, cacambres, streeberries, sto. The above authors
have takes up the question and wided to see whether
have takes up the question and wided to see whether
have takes up the question and wided to see whether
have takes up the question and wided to see whether
have takes up the question and wided to see whether
have fall selected on the surface. They show that is genue
have takes up the question and wided to see whether
have fall selected on the surface. They show that is genue
formativated, but surcobes one for activation disciples
the stress and increase during growth. Registered, the intendian
see observed insetty in laboratory stress, such in accelerapossible they are an acceleration of the product of the plants. Chip the
rep- durable agains such as the decision-incelling can
found in procedure to the plants. Chip the
rep- durable agains such as the decision-incelling can
found in procedure the second on the plants coulding.

The Dedication of the Roosevelt Dam

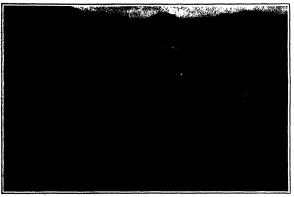
How 240,000 Acres of Arid Land are Being Reclaimed in the Salt River Valley

By C. J. Blanchard, Statistician United States Reclamation Service

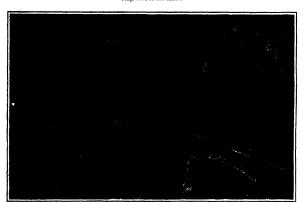
It is emiseatly fitting that the principal orator of the occasion should be former President Rosevett. It was due to his vigorous and virile personality than natiseal irrigation came into being, and it was his peawhich wrote into the statutes of the United States tates of the United States in the Company of the Company in the Company of the Company in the Company of the Company of desert reclamation, the people named for him the imposing structure which has just been finished. DESCRIPTION OF THE ROSEVELLY DAM.

ROOSEVELT DAM.

The Roosevett Dam is the most important masonry structure which the Reclamation Service has a last the most impressive. In the variety of the engineering problems in the magnitude of the engineering problems in the magnitude of the engineering problems of the engineering problems of the engineering problems were surmounted in prosecuting the work, this great work ranks first among the irrigation structures on this continent. The layman and even the engineer will not readily appreciate the complexity of the problems and which were encountered, without an understanding of the locality in which the work was carried on. The dam is located in a canyon heretofore regarded as almost inaccessible except to



Downstream view of the Recesvelt Dam, which is arched upstream with abutments against the solid rock of the canon.



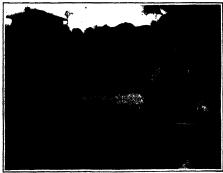
Reight, 388 feet 8 inches; thickness at base, 168 feet; at creet, 30 feet; cost, 50,500,000. The dam impounds sufficient water to court 1,586,000 acres to a depth of 1 feet.

Birdseys view of Rossevell Dam.

the nomadic Apache, who found sate refuge here for many verse, or to the lonely prospector who later ventured into this remote region in search of precious minimals. The mearest radius way is 62 miles away. For 20 miles are supported and forbuilding desert, where every lat of vegetation was correct with thorus was concerned with thorus of the control of the contro tion was covered with thoris and everthing that erawled was deadly. For more than 40 miles the mountains, grahed and flasured into fantantic forms, presented an almost insuperable barrier to ingress in the fast-nesses of the see barren steeps, the turbulant Sate, and the turbulant Sate for the familiar for following the familiar formed Canyon of the Colorado. At the entrance of the googs, between tion was covered with thorns the famous Grand Canyon of the Colorado At the entrance of the googe, between abunch properlies of the googe, between abunch prependicular ciffs and the colorado of the color swinging around perpendicular cliffs a thousand feet ular cliffs a thousand feet high. It cost nearly \$500,-hop. It cost nearly \$500,-000 to build it. In the desert and through the mountains the government put down wells to supply the wants of the future currenans which must travel the new road. A half the new road. A half dozen camps were estab-lished along the route, where beds, feed and forage were provided. All this work was necessary before a stone could be laid in the dam. The main camp at the dam site called for lumber for buildings, food for the men, and power for the men, and power for the contractor in the forest 30 miles away two saw mills were set up and cut several million feet of lumber. Distant springs were piped to







Irrigating the second crop of alfalfa on a ranch in the Salt River Valley.

THE DEDICATION OF THE ROOSEVELT DAM

the reservoir at the camp. Two farms were operated and formulated users, vegetables and forage.

Noteron unbits above the six of the high dam another dam of concrete was laid across the river, diverting a part of the sterem into a large contal lined for several niles such rement and bringing the water to a point just above the Rossevelt six, where it was dromped 200 feet on turbines and generated 4,000 horse-power. This wave was noted by the contrastor; it provided lights for the town, pumped water to the homes, and operated the machinery of the camp. Owing to the inaccessibility of the sixt, the government was forced to make its own cement. A large mill with a daily capacity of 500 barrels was creeted and operated with power from the government plant. It turned out 340,000 barrels of frist-class cement at a saving of more than \$600,000 over the lowest bid offered.

class cement at a saving of more than \$600,000 over the lowest bid offered.

The question of scuring laborers for the preliminary work furnished a most perplexing problem. The work was unsattractive to the white laborers. The climate in was unattractive to the white laborers. The climate in summer was oppressively hot, the sile was far from habitation, and annisements and diversions were few. As one facetions engineer remarked, "While men won't sup-on this job because they cannot spend their money fast enough."

Finally, in desperation and as a last resort, the engineer turned to the Indians who have long dwelt in this part of the territors. It will surprise must people to learn that they proved to be good luborers and for several years served the government faithfully and well. In the work requiring inskilled labor they were as effective as the white man and drew the same pay for their services. It is pleasing to note that the habits of industry and the services are not as the services of the properties of the propert

re in full charge Most of these problems were encountered an are in full charge. Most of these problems were encountered and solved before actual construction of the dam began. Each was anticipated and taken up in such manner that the work proceeded without delay or friction. The contractors, Messay. O'Routse & Company. O'Galveston-Texas who are proposed to the proposed of the contractors of th

circle. From each of its ends abutments are extended on the tangent. About 38 feet on these tangents are the curved faces of the wing walls, and from these their extender faces of the region of the control of 200 feet long on each end at an elevation of 200 feet long on each end at an intention of 200 feet long on each end at the solid rock around each end of the dam, the insertial from which well that the masonry. The spillways are crossed by three-arch reinforced bridges, each span of which as 96 feet in the clear.

Three openings are provided in the dam. At the bottom a tunnel with a cross section 108 feet and \$40 feet long was driven through the caupon wall around the south end. This served a double purpose. During the period of construction it carried the river around the dam. Late it will serve as a shirting or socuring tunnel to remove sill from in front of the dam. In this numel are installed six gates, one set for service and one for emergency, each with an opening of \$45, \$20 feet.

The second opening in the dam is a riveted steel pen-stock 10 feet in diameter which comes out on the down 60 feet in diameter which comes out on the down side at an elevation of about \$5 feet above the

The third opening war the north end of the dan consists of three lines of five-foot cast-lorn pipe passing from the up stream face through the masonry. At the junction of the masonry and the natural rock these converge into a lined tunnel 9 feet in diameter which discharges out of the face of the cliff about 100 feet below the dam.

below the dam.

Just below the dam is a power house 195 × 38 feet in which are installed six S Morgan Smith vertical turbines, each operating a 1,000-kilowatt General Electric 2,390-volt, 35-evcle generator with Lombard governor. In addition two exciter machines and two Pelton wheels are in operation. A short distance down stream is the transformer house, where the current is transformed to 45,000 volts, thence passing to a six-wire transitionness to the companies of the companies this plant

Under the provisions of the Reclamation Act this power development is made a part of the project and in time will be transferred to the land owners, who will then operate it for their mutual benefit and profit. nue so derived should lessen materially, if i wholly meet, the expenses of operating the irrigation system.

Irrigation system. The construction of the Rousevelt Dam has had most rigid supervision. Every rock has been washed clean before being set in place. The cement has been carrially leated at regular intervals On September 20th, 1900 the first stone was laid, and on Pelinsary 3th, 1911, the massivity work was common control of the day of the control of the dam has been a little over \$8.000.000.

on February 5th, 1911, the masonry work was completed. The cost of the dam, has been a little over \$8,500,000.

The chief purpose of this structure is to store the flood waters of Salt River and its tributary, Tonto Creek, which join just above the dam. The storage reservoir has a capacity of 1,384,000 serr-feet, or water that many acreas foot deep. The water enough to cover that many acres a foot deep. The shed supplying this reservoir has an area of 5,800

miles, or an area almost equal to that of C. Rhode Island.

Rhede Jiand.
As the reservoir is located sixty miles from the land to be irrigated, the river will be used as a carrying canal for that distance, and the water will then be turned into artificial casals by a diversion dam which has been built at Grantie Ref. This is a rubble concrete welr 39 feet high and 1,100 feet long, and diverts water into large canals, which in turn supply the entire irrigation system of the Salt River Valley. The casals of the valley have a total length of 119 miles, and the principal interals 808 miles. They are designed to supply an area of \$40,000 acres will be covered by gravity and \$0,000 by pumping.

SALT RIVER VALLEY.

SALT RIVER VALLEY.

More than ordinary interest attaches to this region for the reason that irrigation was practised here long before the first word of our history was written. The valley has been inhabilited by there reace, two of which have vanished. Of the first, or pechistoric race, very little is known. Evidences abound throughout the valley that they cultivated extensive areas and excavation were indicated they cultivated extensive areas and excavation with difficulty and labor, as the excavations were in rock and the work was performed with stone implements. The engineering skill of this people was remarkable, for many of those canals are utilized to-day by the modern systems. Salt River Valley includes several million acres of land with a soil of superior fertility and a climate warm and arid. This produces a region or fermakable health-fulness and adapted to the production of crops ranging from those of the semi-tropic to those of the temperate sones. Its average canifall is only twe inches, and its average canifall is only twe inches, and its average capital or degrees. Without irrigation no crops can be grown, but with it crops grow through-out the year.

out the year.

Agriculture here has become a science, and the duties
of the farmer are regulated very much as those of the
business man. Where crops are intelligently diversified
there is little of the back-breaking, heart-discouraging
work of the old-time farmer. Crops ripen and are harvested at different intervals, giving the farmer ample
time without crowding. With sasared haverests and the
absence of rain the farmer can apportion his time with
absence of rain the farmer can apportion his time with
voids, country belephones, rural delivery, and toolley
lines are being extended from the cities and towns. Its
arizonal facilities are good and are being extended to railroad facilities are good and are being extended to meet the growth of the community. Its educational in-attitutions are first class. In various sections the farmers have organised co-operative associations to market their

crops.

As a whole, the citizens of the valley are made up of a strong, intelligent class who have come from all parts of the Union. They are cosmopolitan and progressive. In points of civic pride and social ideals the community ranks high. Powerty is practically unknown.

With the completed of the Irrigation system which is being constructed by the federal government, we may safely predict for this valley an ers of progress and such actuals. growth of the progressive status and the progressive status

most up-to-date agricultural districts in the world.

Correspondence Politics and Battleship Costs

Politics and Battleship Costs

To the Editor of the Scinswinc Assensari,
The Sixty-first Congress, just adjourned, passed the
naval appropriation bill with the eight-hour law now m
force in our navy yards tacked on to cover private abipyards also, and provided that the battleship "New York"
of the 1910 programme he built in a government navy
yard. The Democrats, who all along have opposed deavy
expenditures on 'navel increase, and who have been cryexpenditures on 'navel increase, and who have been crying "evonous," were responsible for the above measure
In other words, their "economy" was to waste \$8.440,000

It is term that buildings are measured waste standards

In other words, their "economy" was to waste \$\$440,000 It is frue that building in government wards stimulated the private yard construction and raised it to its present high standard, that of the cheepest and quickest limit battleships in the world, but as Secretary Meyer has pointed out, the cost to the government of this simulus offsets the value of the same, and need only be Instigated when the private contractors seem to be lagging Therefore, it is not necessary to have one of our two

provides a second of private controlers seem to be agging from the best of the private part of the provides and the private parts, and the provides and the private parts, and the provides and the latter expect to show a profit, while the navy yards one to the limit, with our merchant marine a negligible quantity, the private yards ought to be encouraged. They are starring for work, and it is enough for them that they keep their enormous plants working. The government-built "Connecticuti" road \$200,000 more than the private-built "Lauisman," and it is estimated that the "Vestal" and "Promothers," could each have been constructed for \$800,000 less if they had been given to the shipyards. This middlerected allow of patientian cost the government \$84,660,000, in the case of the "Florida," but total cost being \$84,600,000, and that of the "Aster ship "Itah," private-built, of "53,946,000 Moreover, the "Itah" post into commission in two months, and it is doubtful if the "Florida" will be ready before next No-curber. Then Compress had to appropriate \$800,000 for whener. Then Compress had to appropriate \$800,000 for whener. doubtful if the "Florida" will be ready before next No-vember. Then Compress had to appropriate \$800,000 for the Facific coast collier above her original \$1,000,000. If the "New York" had heen given to private contractors, \$1,700,000 would have been aseved, which represents the differents between her cost and that of the private-built "fexas." All this totals up to \$8,665,000, a circar wante caused by \$60.000 pilling and the private built of the economy for the cutire country. The only satisfaction to be gained from this is the fact that as the Brooklyn Navy Yard is the only one capable of building battleships, and as only one ca a government-built aship every other year, or one in every four contracted. This is not necessary or one in every four contracted. This is not necessary to the support of the order order of the order of the order of the order order order order ored order or

between times on course voss...

But this is not all. In addition to local politics the labor unions got busy in Washington, with a result that the eight-hour law went through As If the private yards had not enough to contend with! Of course, up went to some of battlendips, and to this law we over the the eight-hour is went through As if the private yards and not enough to contend with! Of course, up went the price of battleships, and to this law we owe the amount of \$1,900,000 mer on the "Fease" than was necessary and \$400,000 on each of the two colliers. This waste will not come on alternate years, but every year, and will increase as the battleships increase in size, as the waste represents twenty-one per cent of the total the waste represents twenty-one per cent of the total twenty of the waste will not all \$1,650,000 may be added the \$4,650,000 for the 1910 and 1911 programmers alone! This means that exclusive of armor and you have a total of \$6,060,000 for the 1910 and 1911 programmers alone! This means that exclusive of armor and armament, another battleship could be built every other year in addition to the two regularly authorized, if the last navel bill had not gone through with the nary yard construction and eight-hour law provision. And yet how a certain group in Congress would how! If an extra ship were to be provided for on alternate years! It is a and commentary on our ideas of economy and partotism when such legislation as this is enacted by our dignified Compress.

Brooklyn, N. Y.

"Aviation," "Volation," or "Flying"

To the Editor of the Scientific American;
In your esterned number dated February 28th a certal
Wells Drury, of Berkeley, Cal., proposes the west
"Volator" and "Volation" for the generally introduced
words "Aviator" and "Aviation."

words "Aviator" and "Aviation."

Your reply was that, by accepting the word "Valation." there would be a confusion with the word "Vol. filon." and therefore meeting with your disapproval.

I heg to say that confusion is absolutely impossible, for the simple reason that the word "Volation" is de-

rived from volare, i. c., to fly, and the word "Vol-ition" is derived from the word volere, i. e., to will; therefore these words are of redically two different meanings! Neither in writing nor in speaking a mis-

meanings! Neither in writing nor in speaking a misunderstanding can occur.

By the way, how is it with the words complement
and compliment? They are always used in their particular meaning without causing an equivocal. There are
a number of other similar words used in our language.

But-returning to the neck-breaking sport-if the
people in Berkeley dialike the "Aviation" and are so very fond of changing them just for
the about the control of the speaking them just for
their sace. "The Flyer" and "the Flying." These
for their use: "The Flyer" and "the Flying." These
words do not only fully replace the atrangers "aviation"
or "volator" and "aviation" or "volation," but are compreheasible for anyone—whether linguist or not.

Grantwood, N. J.

Abour Th. Sonwar.

Aviation Nomenclature

Avistion Nomenclature

To the Editor of the Scharrinz Avisaton;
I am surprising at your reason for not concurring with
I am surprising at your reason for not concurring with
Mr. Drary; I had suggested use of "volator," as a
synonym for avistor, because, as you say, of the word
"otilitien," which concess from the Latin "vola" to will.
I would suggest that you look up "volat," which in
Spanish means to fg. You may, find Mr. Drary's
in the matter,
Chamar-Assan.
Chamar-Assan.

The Poured House-

The FOURED HOUSE.

In his article on the one-spice house (see page-1878),

Mr. Perry expresses doubt as to the practicability of
Thomas A. Eddens's plan of making monolities heases.

A copy of this criticism was sent to Rry Eddens' tool-law

Problems of the criticism was sent to Rry Eddens' tool-law

"Mething pleases me more than to have majnered by

"Mething pleases me more than to have majnered by

"more and the complete of the conception of the reserved

major have to the control of the conception of their reser,

and the experiment will be carried to a fasicle.

"Orange, N. F., March Sad, 1915."

The Problem of Waterproofing

The Properly Built Concrete House is Dampproof

By Ralph C. Davison, Consulting Engineer

Description of the greatest obstacles to the English speak of concrete construction to-day, especially far, private destillage, lies in the flee which has granted being on the greatest private destillage. He is the flee which has granted being on the greatest private concrete statistic private control of the concrete statistic private control of the control of the

There is a large and growing demand for good waterproufing materials. Probably nothing will show this beter than the statement that some at to ten years age
there were about two or three firms, at the most, who
were sanking materials with which to waterproof cement.
To-day there are probably upward of fifty at least
and a new one coming into catterone cupry month or two.
Notwithstanding the number of the above companies they
all seem to be making scough to exist on, which goes
all seem to be making scough to exist on, which goes
a practically unlimited. The writer will not attempt
to go into the details of the maptite or demertix of any
of the above waterproofing materials, as this article is

By Ralph C. Davison, Consulting Enginee of its as shown at 5 b. When the foundation wall has been completed, the portion of the waterproofing has been completed, the portion of the foundation wall and securely cemented to it with either asphalt or coal tar pitch, as shown at e in the small detail B in Fig. 1.

After this has been done, the next step is to apply a waterproofing course to the outside of the foundation wall from the ground or grade line down to the top of the footing, as shown in the small detail B in Fig. 1.

After this has been done, the next step is to apply a waterproofing course to the outside of the foundation wall from the ground or grade line down to the top of the footing, as shown in the small detail C at d in Fig. 1, care being taken to see that it also over and is well cemented to the part of the waterproofing course which has just been turned up against the bottom of the cared for. The rough concrete foundation for this should be brought up flush, or on a level, with the top of the footing and should be made fairly smooth. To this surface should them be applied the waterproofing course for the cellar floor; care must, however, be taken to see that it haps well over the waterproofing course in the place the next and the surface should them be applied the waterproofing course throughout the entire foundation waterproofing course in the scale of the footing, as shown at e in the small detail C in Fig. 1.

After this waterproofing course is in place the necessary thickness of concrete to resist the existing waterproofing course throughout the entire foundation which, if properly ladd, will result in the procuring of an absolutely dry cellar, regardless of how wet or damp the ground around the house may be.

If space does not permit of placing the waterproofing course on the outside of the foundation walls, a curtain

pose, and with considerable success, is by firsted lime. Five peer cent by weight of this material aided to the cement used will give excellent results, without interfering in any way with the strength of the concrete. There is no question that good results have been and can be obtained by the incorporation into the mass of such materials as mentioned above. The only objection which the writer has to this method of waterproxing concrete is that in case of settlement in the foundation, cracks will develop. If one could be assured that there will be no settling, then it would be safe to use the integral method of waterproxing. But where there is any doubt it is best to use a regular waterproxing course, as explained in the control of the control of



Fig. 2.—Below-grade water-proofing in limited quarters. THE PROBLEM OF WATERPROOFING

Fig. 3.—Various methods of applying flashings and counter flashings.

not intended to be a treatise on waterproofing, but is merely intended to impress upon the prospective builder the importance of waterproofing concrete and to give a general idea of how the waterproofing question can be attended to so as to secure a perfectly dampproof concrete house.

The water-proofing of the foundation and the parts of the cellar walls which are below grade will first be con-sidered.

the cellar walls which are below grade will first be considered.

It is surprising, especially in the construction of small houses, how little attention has been given to below grade waterproofing by architects and builders. It is of the ultimate implicance, and only from a commercial point, but for the ultimate efficiency of the work, that the structure be designed from the start with a due regard to waisrproofing. The above fact cannot be too strongly emphasised, for it will prove both a loss of time and meany to build without in some way caring finding and the structure of t

Il there mass will penult, the exercision paids large enough to provide unflictent of the foundation and handling the property against the above to the foundation and handling make. Then other the foundation is not convenient to the contract of the contr

wall, as it is called, made of one thickness of brick or lean concrete, may be set up. Then on the inner side of this wall, as shown in Fig. 9, the waterproofing should be applied.

wall. It is only necessary to use the above methods where there is more or less water pressure to contend with. If one only has dampones to provide against, one or more good heavy coats of asphalo or far applied but on the exteriors alize of the foundation wall demonst to contend with, one of the many preparations of asphali in semi-liquid or liquid form, which can be applied cold with a brush, will be sufficient to prevent the daupeness from striking through. This is a cheap method and has proved most effective in many cases. When filling in the ground around a foundation treat-int he above meaner, care must be taken that no sharp stones, giass or tin cans come in contact with the sur-face, for if they do they may cut or abrack the damp-proof ceating. In many instances a thin layer of ce-ment is plastered over the dampproofing course in or-der to protect it from any damage that might occur from the above cause.

ment is plastered uve.

der to probet it from any damage that mign wonfrom the above cause.

Other methods of waterproofing concrete for belowgrade work are used; they consist chiefly of what is technically known as the integral method, by which is meant
the incorporation into the cement of some foreign subctance, which is much finer than the particles of cement
used. The Tandessential principle of this system is to
mechanically 201 the minute voids, which not only theoretically but practically do exist, between the grains of sand
and the particles of coment, and to thus render the mixture density and is appreciate to describe the conture density and is a pervious to dampness. There was
many substances on the marchel to make the to
the density of the control of the content is pasted to the sand and the particle of the content is pasted to the sand again many are in the form of
a finely meand as a supervised as and for this pur-

faces of the exposed walls in order to prevent the penetration of dampness. They are largely used as a substitute for wood lath, metal lath or hollow furring blocks, or they may be used in connection with any of the above in order to insure an absolutely dry air space. If used alone, it is well to specify two coats over whot the plaster can be directly applied, thus doing away with the air space and the additional expense of furring, and are any of the above on some of the highest class apartiment houses and loft buildings, but it does not keep the driving rain from entering into the outer surfaces of the purous brick or concrete walls. What it does do is to form a waterproof film between the inner side of the walls and the plaster and thus prevents the dampness from soaking into the plaster as it otherwise would do. Many object to this method of dampproofing for the reason that it does not keep and the prevents the dampness from soaking into the plaster as it otherwise would do. Many object to this method of dampproofing for the reason that it does not concrete wall saturated with rain not only takes a long time to dry out, but its appearance for two or three days after a storm is anything but pleasing, inasmuch as it dries out unevenly, which causes it to present a blotchy and unsightly appearance. Therefore many architects preferably treat the outside of the wall with a good waterproof peint and in many cases, where they have doubts as to the waterproofing qualities of the outside treatment, they make doubt as a trapland above.

A word here in regard to the proper paint to use for coating concrete may not be amon, Il invised oil paint

as explained above.

A word here in regard to the proper paint to use for ceating concrete may not be mines. It inseed oil paint is to be used great care should be taken to see that the concrete or cement which is to be painted in at least one year old. This will give it ample time to throughly cure and dry out. Then before painting, the surface should be well washed with a week solution of murital said followed by a thoroughly good washing with clean water. This will not only clean the surface, but will help to neutralise the alkall in the cement, which if left there will saponify the oil and cause the paint to rack and pel oif. Care must be taken to see that the wall is entirely dry before painting is started if good results are desired.

(Continued on page 890)



geodigious has been the growth of the Portland and Industry, so marvelous its development, that the life its breathless endeavor to keep track of cerescing uses of this wonderful material has scarce had been considered to the control of the contr

Portland and was considered the hardest of the known building stones. Portland coment was at first imported into the United States from Germany. Then the discovery was made that this country also contained materials from which the product could be manufactured. When, finally, we became intersted in the product, with characteristic energy and with improved methods and appliances forged ahead until today American Portland cements are the schowledged superiors of any in the world, not only its quality of product and improved methods, but in the quantity also. In one region alone, the Lehigh Valley district, in the state of Pennyalvania, more Portland cement is manufactured than in the whole of Germany and England smalled.

Within a decade (1899 to 1909) the cement industry of Within a decade (1899 to 1909) the cement industry of the United States has increased twelve hundred per cent! And this growth has been due to the fact that the American public has been quiek to grasp the possibilities of his adaptable material. Here is an ideal building material, a stone that does not have to be hewn from soild spek, but merely mixed up like a paste with broken stone fid and and then poured in place! Could one sak for anything simpler or more opportune at a time when the scarcity of lumber is becoming serious? No

woulder the coment industries have grown.

Portland cement is a chemical composition, a triallicate of lime and alumina. It can be manufactured wherever these materials can be found. In the Lehigh Valley, Pennsylvania, district, where for a long time 15 per cent of all the Portland cement in the United States was propositioned of all these pennsylvania of the composition cent of all the Portland ciment in the United States was manufactured and where to-day about 80 per cent of it all is still manufactured, there are extensive natural deposits of what is known as exement rock, which, with the addition of a small percentage of lime, contains the ingredients before mentioned. This raw material is quarried and in various ways conveyed to the plants, where with a system of crushers and pulverling machines it is crushed and reduced to a very the powder. The prowith a system of creaters and puterrang meanines it is crushed and reduced to a very fine powder. The pro-cess is continuelly controlled by chemical analysis, a corps of expert chemical to leng in charge of this work night and day. The resulting puterised raw material of the proper chemical composition is then fed to rotary klina, where it is burned to what is known as "cement clushes."

kilns, where it is burned to what is known as "cement clinker."

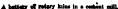
In the early days in Germany and Ringland, as well as in the United States, Portland cement was burned in what were known as dome kilns, the mixture of limestone and shale in various shapes being set in these kilns with alternate layers of coal or coke, the product of a kiln seldom exceeding 100 barrels a day. In the year 1890 one of the largest Portland cement companies began experimenting with and rapidly developing what is now known entities and the state of the second control of the second control

coal into the klin by means of an air blast, the coal bring ignited as it enters the klin. The resultant clinker is than cooled and pulverised into a very fine provides and because the Portland consent of commerce. This process of grinding the raw material set also the children has been the service problems of the control problems. The process of grinding the raw material set after the coal of production. The reduction of any material to a fine powder by machinery involves great cost, and particularly was this the case with the materials one fine production. It was early determined that the finer the raw materials were ground, the more infusiant the instature of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the control of the component parts; and while in the sarly stages of the component parts; and while in the sarly stages of the control of the component to the control of the production per hour but also materially assists in reduction the control of the control of

nearly front man, writer equipment not only increases use production per hour but also materially assists in reducing the cost.

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Saving Trees by the Use of Cement

How the Tree Surgeon Stays Decay with Cement Fillings

By M. L. Davey

Mesuie and suffering are so closely us-ine ordinarily regard the alleying of hameuted fraction of medicine and sur-pt sensitives to overlook the economical intelly wishe the maintenance of health was implied. The economic factor is of intelleging displayed in votarinary prac-us also them it main to a sile-time.

sense here is here also changed in voterhaary practices sense here in the alleviated Washings count to the negative being done to purely important to the country of the respective for makentan is practically absent This garden as the reason why we hardly class plant surgest always garden in the property of the property of the country of the property of the country of the property of the property

or stone.

The bark is a protection for the tree. Where the bark vermans intact, the woody fiber eff the laudde are preserved for generations and for centure questions some outside agency kills the tree. Destroy any part of the bark by any means whatnesseers, and when the protection is gone the wood decays. Queen the wood decays. Queen the wood decays. Queen the wood decays. Queen the wood decays of the progression of the wood decays. Queen the wood decays of the wood decays of the wood decays. Queen the wood decays of the wood decays of the wood decays. Queen the wood decays of the wood decays of the wood decays. Queen the wood decays of the wood decays. Queen the wood decays of the wood decays of the wood decays. Queen the wood decays of the wood decays of the wood decays of the wood decays. Queen the wood decays of the wood decays of the wood decays of the wood decays. Queen the wood decays of the wood decays of the wood decays of the wood decays. Queen the wood decays of the wood decays o is gone the wood decays. Once decay secures a start, its prog-ress is rapid. It continues un-til checked by artificial, meas-ures or until the tree becomes so weak that it is blown over in a wind-strom. The tree may appear to be in a perfectly healthy condition even with the entire health events are supported to the inside rotted away, sin-censuse the vital parts or four inches on the) are the last to be de-l. Decay attacks and grates the dormant tis-rotted and gradually works of

sty of the foliage. A rich-green, abundant foliage indi-cates beath, and vies seven. And still aimost the en-tire inside may have retted away!

Tree forgery, or that part of it pertaining to the filling or cartites, is eaply comparable with denistry. The three fundamental principles of each are the same. The denist must rezoroe all decay and prevent more, prepare the cavity so that the filling will stay permanently in place, and excided all foreign substance. The tree surgeon must do the same things, although the means to that end may differ somewhy.

must remove all decay and prevent more, prepare the cavity so that the filling will stay permanently in place, and exclude all foreign substances. The tree surgeon must do the same things, although the means to that end may differ somewhat.

To remove the decay from a cavity requires chisels and gouges of various lengths and sines. The smaller cavities are not exceedingly difficult, although they require the larger a cavity becomes the larger as cavity as cavity and the larger as cavity as cavity and the larger as the larger as the larger as the larger cavity as the larger cavity

of the fact that there will be some sway to the tree. Oftentimes it is necessary to put the cement in in sections, leaving natural joints which will permit the sway-tens, leaving natural joints which will permit the sway-tens of the control of the sway that the control of the

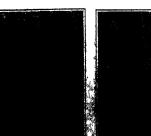
vigor in a free tie heart will kept no roll of the an over the filling. Nature responds wonderfully to proper teach and tree is a living creature! This is the foundation fact of free surgery. It ministers to the human family in composition, the same properties of the surgery. It ministers to the human ferost. It holds in check the waters that go to form the rivers and insures their continuity. It robes the hills in green and hides their gaunt and lifeless forms. It gives grace and heatly and verdant loveliness to the valleys. It shades the urban highways where masses of mankind past to and the urban highways where masses of mankind past to and the breathing places of the people. Its contribution to the food of man is of untold measure.

A tree is a fuling companion to man. It is quite proper that the highest development of the vegetable kingdom should not use the profession of the well-ging of man. Man should in turn give it reasonable care and protection so may be a maximum. Because a tree is a liding organism it is subject to decay and premarture death. Tree Surgery is the concrete expression of man's desire to protect the physical well-being of the trees and preserve them for his own pleasure and protynic and concerned of man.

A New Type of



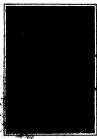
The filling in sections to protect it against sway.



The original contour of the tree must be restored.

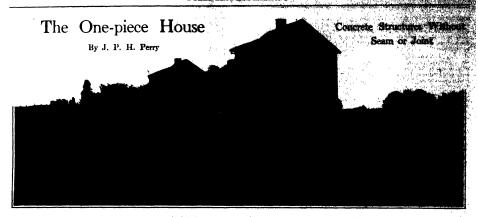
The serity was large enough for a man to work issued.

Note how the new bark is growing over the cament.



A New Type of

A New Type of Submarine Boat
THE Paris daily papers a state that a submarine boat of a new type has just beautiful to the submarine of the submarine of the submarine is that it is operated to the submarine is that it is operated by a single engine which works at the surface as well as under water. According to the present statements, M Maurice, a naval officer, invented a system of boiler such that it is using a suitable storage material there of holler such that in using a suitable storage material there is enough heat stored up while funning at the surface so as to be utilized when the surface so as to be utilized when the boat far running under water. In this way a greater speed is obtained than what prevails in the case of submarines which are clercite motors. As in other submarines of the navy, the process is kept secret. During the tests the performance of the apparatus is said to have been quite satisfactory.



MONOLITHIC concrete houses may be grouped into three classes, dreproof, semi-freproof, and non-irreproof, and the purpose of this article is to describe, first, how the houses included in each of these qualifications are built, and, second, to show the advantages each of these types, possesses as compared with other and perhaps better known types of home construction.

By "monolithic" concrete is meant concrete poured in place in distinction to concrete made into blocks at a central point and distributed and then laid after the names of brick work.

Gors, and roof are of reinforced concrete. Brick or field stone may be used for the exterior and the frame work of the house made of concrete, but here we shall discuss only the all-concrete house, as it is assumed that the man in the street is familiar with the stone or brick bouse. Despliet the vigerous publicity and advertising campigin on the part of the concrete noncrete house will concrete house will exceed the concrete contractor to the effect that concrete houses when the fact. A modification of the all-concrete house may be prepare to be obtained at prices reasonably close to the more conventional class of house. But in the general sense of the word, a concrete house will concrete for a conventional class of house. But in the general sense of the word, a concrete house into example concrete factory or warchouse except that it generally calls for factory or warchouse except that it generally calls for factory or warchouse except that it generally calls for factory or warchouse as one of the word, a concrete house in not seasonably different from the construction of a not sense in the concrete forms and which he knows can be executed in concrete second, to have a contractor who is experienced in this class of construction and under no cferum-stances in the contract to the ordinary mason builder roof builder who knows little or nothing of concrete house with general, and respectably or reinforced concrete house work.

house work.

A successful concrete house cannot be obtained unless the architect and the contractor start in figors the brighning to make a concrete house. Not only must the architect and the contractor work together, but they must have the active co-operation of the owner and must have a series concrete house and not a house built or entered the contractor work together, but they expect will hok like a stone or a brick house. It is a series of the concrete, which he expects will hok like a stone or a brick house. It is a series of the concrete houses and house built of the contract houses scattered throughout this country which are in every way natisfactory to all parties who have had anything to do with them. The details of the construction of these expected houses are many and largely technical. It will be impossible within the links of this article to go far into a description produced within the links of this article to go far into a description produced within the links of this article to go far into a description of the construction of these expected houses are many and largely technical. It will be impossible within the links of this article to go far into a description of the construction of the co

No expected for considerable for the witer's belief, no satisfactory form or mold system there is no satisfactory form or mold system has been found. There has been considerable talk in the technical, and in fact in the popular press, about metal forms and uniform forms, etc. Tip to date more of these "systems" have proven especially commissed, have proven especially commissed all practical. None of them has been also prote to any extent for leasure work. The design of the forms

and their handling is a matter largely of experience in so putting the forms together that they
will be light to present leadage of the control of the
sufficiently strong to sustain the load of wet concrete is a
support alignment until the concrete has see. They must
also be so designed as to be easily removed without injuring the concrete with which they have been filled.
Furthermore, this process of removing or taking down
forms must not demolial them completely, but must keep
them as far as possible in their original shape so that
they may be used again with naintume agenue. The
evonousy of concrete construction depends almost wholly
The materials which go to make up the concrete are in
general Portland cement, clean sharp sand, well graded,
and either gravel or broken stone. The close of the
gravel or broken stone will in many cases be a matter of
considerable study as it is possible to obtain beautiful
effects in the finished concrete with carefully selected
aggregates.

considerable study as it is possible to obtain beautiful effects in the finished concrete with carefully selected aggregates.

The design of the floors and walls as far as their strength is conferenced is a matter of pure engineering and one which has become so largely standardized at the grant of the strength is conferenced in a matter of pure engineering and one which has become so largely standardized at the the character of exterior and interior floating to the character of exterior and interior floating to be character of exterior and interior floating to exercise the character of exterior and interior floating to the character of exterior and interior floating to exercise the character of exterior and interior floating to exercise the forms, practically untouched except perhaps for slight pointing and rubbing to fill up any both bales or prockets and remove any irregularities on the surface; the surface may be cubbed with wire brushes to remove the thin skin of cornent mortar which generally comes to the surface composing the aggregate. This method produces a wagh surface generally of uniform texture and often of interesting color; the surface may be pathed with vertous special cement paints or may be washed with a thin grout (crement wash) which is generally done to give a move uniform color to the concrete than it is possible to obtain if the concrete is left as it came from the forms of whe exterior surface may be given a cost of stuce or pighera. discretion of the architect with the advice and experience of the contractor.

The interior finish depends on the treatment of the

of the contractor.

The interior finish depends on the treatment of the walls. One hears a great deal of popular prejudice about concrete walls being damp. As a matter of fact, a monoilithe converte wall six inches or more in thickness, if properly built of wet rich concrete is impervious to

moisture. This stakement can be absolutely backed up by reference to the many hundreds of concrete fasteries and warehouse, whose walls have not hem damp-persedue and warehouse, whose walls have not hem damp-persedue or treated in any way, and whose owners have no compelication the score of dampines. There is a slight perselability, however, of there being configuration. In all probability, if there is any condenditions, it will posture on the wisdows and not on the walls. There is a temdency, however, toward a cold drown fraugath in severe weather along the walls. This is ostionable if a chair-plaint for this reason. In house when it is generally considered good practice to fur the walls. This have be done with a bellow tile, wooden studding and Jakis, marks a bodient and the constitution of the state of the plaint for this reason. In house work it is generally could be moneithly wall with his spaces specially it with the idea of preventing hest monthetics, and cinnequent elimination of condensation.

The interior treatment, as above sugginated, depointed upon the way the walls are finished. If no least of discussions to the same of the state of the same of the state of the same of the state of the same of the same of the state of the same of the state of the same of the state of the same of the same of the state of the same of the state of the same of the same of the state of the same of the stat



in that the roots quoted are very low, that of Superior structure. On the se value of a house tand its contents when the tank read house. It is impossible to recover of private papers, helrhooms, works quifty treasures that are leasuring the content of the cont a man rose of private papers, heirbooms, works insury feasibly treasures that are irreplace, branging there is always the herrible probability in the first part of fife in a first, and the knowledge that the obstelly subsumable should be worth an incelled many in the part of many to its powner. A concrete house in a saves. A store is entirely freproof, only heartfully find his provent of a first starting in a generate of the part of the contraction for the part of the contraction for the contraction f

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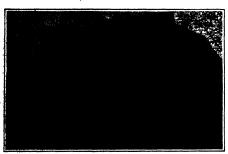
iendenspo better than almost any other type of construction. We note and its design seem to adapt themselves well to the surrounding landscape, and there is none of the siveness generally felt when no looks at a brick-se mesoary bouse.

The cost of an all-concrete house is what the prospective heme builder is essentially interested in. On a large house, say 80,000 and updared in value, concrete can be used as above outlined at a cost which will not exceed that of brick or many practised, by much over 10 per cent to 15 per cent, and may even not exceed it at all. Compared with an all-frame house, concrete will run per-haps 30 per cent to 30 per cent more in cost. A very large house can be built in concrete at about the same cost as in other materials of the more ordinary type. In looking at the cost of a home, however, the owner cannot afford to be guided metrely by the intuital cost or creally inherents its builder. If housened charges, the value of additional fire protection, repair items, depreciation charges, vermin loss, and the other annual upleacy items are considered, and evaluated, it will be found that a concrete house that appears higher in first cost, is in the end the best investment that it is possible to make in house buildings, or this stricks, granolithic concrete. At the beginning of this stricks, granolithic concrete house. The second class, or semi-fireproof concrete house. The second class, or semi-fireproof concrete house, differs from the all-concrete house in that the walls and floors are built of concrete, whereas, the coof is built of wood framing and shingles, or wood

framing and tile or slate. This type of house is somewhat less expensive than the all-concrete house and in many instances marry equal in the advantages. Of course, in the ordinary detached house, here is little danger of fire except from the interior, and if the roof is burned off, the rest of the house is not seriously damaged, the accident resulting in little more than inconvenience. The repairs and upkeep of a roof of this character have to be considered and it will in many cases be found profitable to spend a little more money and get a concrete roof than to try to economise. In talking of a concrete roof, the idea should not be obtained that no concrete roof, the idea should not be obtained that no build a concrete roof with a conclusion of the concrete roof facts of the concrete concept with gravel or slag. If it is preferred, slate or special tile can be used with concrete advantageously. In designing roofs for concret houses, every effort should be made to keep the roof fat, so that the conts of the forms for forming the concrete care not expensive. If peaked, or gamberl roofs are shown on the plans, the cont of constructing the same in concrete comes very high The design of a concrete house can be made most acceptable if flat roofs or very slightly sloping roofs are specified.

The proposed contemplates the use of concrete only for the foundation and walls, the interior and roof being all wood or other material. This house is in no seme fare-proof, though it is unquestionably more fireproof than an all-frame house in that in the event of fire the walls at least will be left standing, and ready for use again. This type of house has several advantages over the ordinary (Continued on page 20.)

(Continued on page 202.)



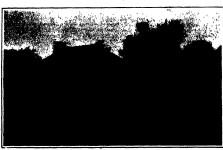
at is not inconsistent with beauty of effect.



House of solid concrete, roof included,



me at Highlands, Mass., made of solid concrete



Bungalow of pleasing design at Bryn Mawr, N. Y.



A venue of all OF AMENDATERIC CONCERNS MOUSING SHOWING GREAT DIVERSITY OF TREATMENT

.



acrete studio in a charming setting.

The Cement Market

Conditions of Manufacture and How They Benefit the Consumer

By Allen E. Beals

STRANGELT varied is the picture presented to us when we aumon up before our mind's eye the many uses to which cement is put to-day. The American faturer uses it to make hen's neats that give no harbor to insect peats, that can be scrubbled and baked, thus insuring absolute disinfection. Of cement are made such varied structures as a pig sty, a freight harge, and the rampart of a fortress. Science has shown that a nest egg made of Portland cement is cheaper and more permanent than a china one, and with the same material a great government is building the world's greatest waterway. Like electricity, cement seems to be destined to render to manifest in services whose extent can hardly be properly realised; and the public mind weaves a romantic future for it.

for it. Imagination almost qualis at the vast amount of capital invested in this industrial prodigy. The investment in the United States alone is roughly estimated at \$8000-800,000, and the industry is only two score years old in America. Graphic illustration only can give the layman an idea of its phenomenal growth.

Between 1870 and 1879 the total output of Portland cement in the United States was \$8,000 barrels. This does not incide output figures for Puzuolan and natural cements. American mills alone turn out £,000,000 barrels assuming that construction work, as compent manufacture, continues uninterrupted seven days except as material and content to the content manufacture, continues uninterrupted seven days of 300,000 intress, assuming that Construction works as cement manufacture, continues uninterrupted seven days in the week. This represents a total output in 1910 of 45,000,000 harrels. One company shipped a dally aver-age of 5,500 barrels to the Panama Canal, or a little more than 2,000,000 harrels in 1910.

more than 2,000,000 hereis in 1910.

If nine trains, each ten miles long, aggregating to a total of 14,000 freight cars, could be procured to handle list great 1910 shipment, they would herely be able to hauf the total shipment in one load. If this wast quantity of Portland cennent were to be placed in a single herrel proportioned exactly as an ordinary cennent barrel is partermed. It would measure 984 feet high. Its weight would be 800,000,000 pounds, or 400,000 short tons. Sometiment of the proposed of

vessels.

Picture to yourself a barrel of Portland cement reaching to within a few feet of the top of the Eiffel tower, the top of the lantern of which is 884 feet above the street level, or so high that the famous Flation Building in New York city would have to be placed upon the top

of the Metropelitan Building, the world's talliest inhabited structure, before an assignment could reach the top to get at the contents of the barrel. This will give a fair idea of the size of the receptact that would be required to citate in 1910. The terreturn comment is additionable to the size of the pounds grow to a barrel (the weight of a barrel or cement being computed at 360 pounds not to the basis of 460 pounds grow to a barrel (the weight of a barrel or cement being computed at 360 pounds and to the barrel stack weighting 50 pounds). One cannot conceive of such a weight until it is stated that if every man, woman and child in the United States weighted 130 pounds, the total weight of eur portfun of humanity, based upon the 90,000,000 or population at the last census, would be only 13,000,000,000 pounds, and our barrel would still have 14,100,000,000 pounds to its advantage.

our barret would still have 18,100,000,000 pounds to its advantage.
These totals are staggering when the output for the nine years between 1870 and 1879 is considered. The total output for that period would have gone into a barrel only 100 feet high or as tall as a six and one-half story building. The rate of growth and corresponding decline in prices and indication of built by periods in the fadustry are shown in this table:

Year,	Quantity Manufactured, Barrels,	Price per Barrel Represented in #6-Cont Picces,	Height of . Imaginary Berrel					
1980	49,000	19	81 feet					
1690	834,000	8	169 feet					
1900	8,413,000	4	476 feet					
1910	74,000,000	8	980 feet					

1910 74,000,000 8 990 feet
One would suppose that under such wonderful strides
in derelopment cement producing companies would be
reaping tremendous profits. Here is the tragic side of
the industry.

The prospects of quick returns upon investments and
the exploiting of production figures have been a source
of much profit to the promoter, whether the same be true
of the investor or not. There are 108 plants in this country to-day. More will start this spring. Each company
is producing just as much as it can regardless of maxsorely squeezed last year, when competition was conscienceless.

The following statistics show the wonderful errouth of

scienceless.

The following statistics show the wonderful growth of the industry and also the decadence in prices:

	Number Barrels Produced.	Value.	Price per Barrel at Mill
1870 to 1879	82,000	8946,000	83.00
1880	49,000	126,000	8,00
1881	60,000	180,000	2.50
1889	85,000	191,950	9.01

	*	4.5 4.7 (4.78)
Physics Barrels		Bride par President
	Variation with	214
90,000		
100,000		
100,000		
\$50,000		2490
	800,800	1.00
884,800	704,000	5.00
444,518	967,481	7.18
847,440	1,183,600	941
9,077,775		
	4,910,717	3 3.65
8,659,966	8,074,97	1.48
8,463,080		1.05
10,711,995		
17,930,644	96,884,071	3 1.81
99,342,978	97,713,81	1.44
95,808,981	93,355,11	206
88,946,619	33,945,96	7 .86
	89,466,18	1.18~
74,000,000	35,500,00	b , +
	29,342,978 26,804,981 35,944,919 46,468,484 48,873,310 81,079,919 68,808,461	90,000 929,000 930,000 150,000 150,000 930,000 150,000 150,000 150,000 900,000

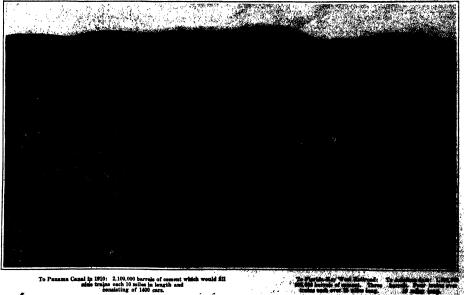
It will be observed that the quantity of consent a factured in 1810 showed an increase in production \$1.3 over 1809, but the price was lower blank than

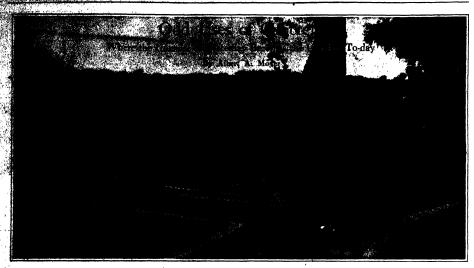
FINDING NEW OUTLETS: FINDING NEW OUTLETS:

Many companies were forced to still sheir product thelow cost during 1910 as a result of a cithninstine of bonditions which had been forescen but instead with more or
less indifference for several years. The curtain west up
on the tragedy carry in 1904, when manifectures began
to feel the tremendous impetus in the market. Inside
the productives being actified with modest profit, interterritory selling is labeled -fire of business antagonities, and
in 1906 this was forced to a head by the youngest their

in 1809 this was reveed to a need by the youngest reva-in the field.

The United States Steel Company found it somewhat difficult to get rid of the great piles of alag from its (Continued on page 1911)





IN MES SEARCH for saitsche material for the condifferention of the Eddyriasse Lighthomse in the English
Channel, Joneph Apellio, of Local, England, experimented
with hooks and clays were united together and burned
in a kiln to a clinker. This was reground, producing a
hydrasilic censent, which would harden within an ecosousional time either in air or under water. Joseph
Apellion and Search in 1811. Modern converts, therefore, is
not yet a century old. To the inition of that day the
Lighthomas was a remarkable novelty. He are proposed
and curious. This lighthomas is still standing.
The character of modern concrete and that of ancient
concrete is vestly different. Joseph Apedin did not rediscover a lost art. The ancienta in the centuries B. C.,
as well as early A. D., employed concrete extensively
and obtained pernament and issting results without the
use of a hydraulic cement. Their concrete, however,
acquired its strength slowly, which in those days very
built slowly. Their concrete was not made of a
pre-determined mixture manufactured into a cement
or honding material. Instead they used the material furnished by nature in the form of lime, clays,
volcanic rocks and gravel. These were mixed together
in preportions which would result in maximum density,
placed in board forms or molds—very similar to those
of the present day—and allowed to cenani in place for a
considerable length of time until sufficiently hard to supform the surface.
There was, however, as ac-called
manufactured in the conforms, used as feundations for the temples and other
builting the pyramid in Reyn's
There was, however, as ac-called
manufactured in the Roman
Forms, used as feundations for the temples and other
builting the wood and the spaces
where the bracking was taken out.
There was no concrete used in
buildings the two day and the spaces
where the bracking was taken out.
There was, however, as ac-called
manufactured in the Roman
Forms, used as feundations for the temples
and gravel. The holes where
the spaces of the surface.

horizontal and ran through the wall. The lime would harden more quickly than the mixture of lime, clay and gravel, and would tend to give stability to the wall so that the forms might be taken down at an early date. The main characteristic of all Roman, Egyptian and Moortah convecte might teach the engineer of the present day a leason, in that widds are never seen and the surface is never placeted. Maximum density must have in the size extending over two leastiful Cortuthian columns, the broken end projecting 10 or 12 feet, still testifies to the excellent workmaniship of the Romans and solves that concrete made of the poor materials then obtainable is everlasting.

Undermeath the present church of St. Clement on the Via Giovanni, Rome, is the old church of St. Clement, discovered shout forty years ago. After that thing also underneath, day deeper and found what is supposed to be the house of St. Clement, the walls of which are of concrete. The writer was given the opportunity of inspecting those walls, and using a hammer and spike found the concrete to be as hard and dense as any made in modern times.

All these in their day and generation were undoubtedly unusual applications of concrete that exist at the present day. Twenty-five years ago concrete side-walks were unique and unusual. They were called artificial flag stones. I amp black was employed largely for the purpose of instating blue flag stone. This

aboninable custom has lived to the present day Retaining walls and walls for buildings were exceptions of the control of the c

hey could not dig this concrete out; they had to use dynamite, so firmly was it set.

An example of concrete telegraph poles may be seen across the Hackenasch neadows on the north side of the Permyslyania Railroad for gentler mentions of the promyslyania Railroad for gentler mentions of a polytomer concrete vase made of which in the form of a polytomer concrete vase made of variously colored marble chips and marble acreenings exposed by scrubbing, is here illustrated. I am informate that or distribution of the property o

unique.
Keeping in mind that concrete is
permanent and economical for any
purpose in which the constructior
course in contact with the ground
or water, the reader can allow his
imagination to play and daily fine
himself an inventor for new and
peculiar concrete.

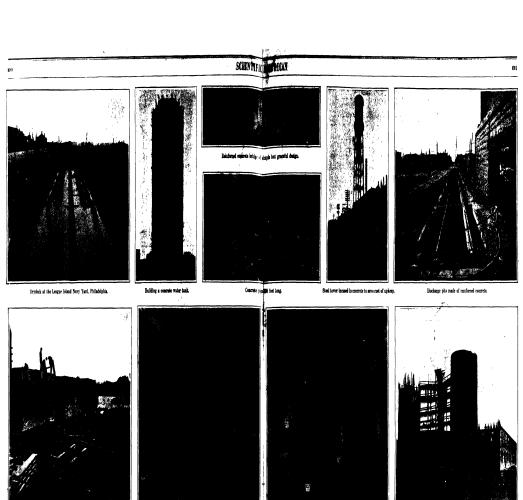


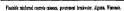
Tower of the Albambra built in 13th contury. Note the board marks.

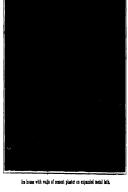


ome urn made of black and yellow aggregates.

ODD DEES OF CONCRETE









How cement can be used to advantage for staircases.



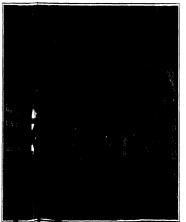
Two siles and a building of cement blocks in course of construction.



An example of the use of concrete in a mina.



A pleasing example of controls block week,





Example of the rigidity of concrete,

The Mammoth Locks of the Panama Canal

The Greatest Work of Concreting in the World

By Walter Bernard

It is scarcely possible to talk of the Panama Canal A without drifting into the superlative moods so greatly does this unique work exceed any other of the kind yet attempted. Particularly impressive are the Squres which tell the story of the quantities in the huge monolithic structures, locks, dams, spillway, channelway, et ceters, which go to swell the total amount of concrete in the finished canal to five million cubic yards.

There will be twelve locks in the canal, all in duplication of the story of the control of the con

flight at Gatun. Incidentall these locks are being built through a low hill or mound, through a low hill or mound, which is located at the east-erly end of the Gatun dam, a vast artificial rampart of sand and clay, nearly half a mile wide at its base, 400 a mile wide at its base, 400 feet wide at the water surface, and 100 feet wide at the top, which extends across the valley of the Chagres River for a distance of one and one-haif miles. At the center of the dam is the spillway, a channel 300 feet wide and 1,900 feet At the center of the dam's the spillway, a channel 300 feet wide and 1,300 feet long, heavily lined with concrete, which is cut through a control of the dam in the hottom of this opening being about ten feet above see kerel. During the construction of the dam the Chagres River is being allowed to flow through this opening. When the construction has advanced sufficiently to permit the Gatun Lake to be formed, the spillway will be closed with a concrete dam and fitted with gates for regulating the water level of the lake.

titted with gates that the content of the like.

The Gatun locks will form a single concrete mass 3,800 feet in length and 380 feet in width. It consists of two side walls and a central division wall. The floor consists of a mass of concrete, 90 feet in maximum thickness. The side walls are 48 to 50 feet in width at the surface of the floor, and taper on their outer face from a point \$41/3 feet shows the floor, to a will be 60 set of the floor of the floor will be floor to the floor of the floo

chambers will be filled and emptied through lateral cul-wrbs in the floors, connecting with main culvers 18 feet in diameter, formed in the side and center walls. The lock gates will be of steel, built on the critilar principle. They will be 7 feet thick, 68 feet long, and from 47 to 88 feet high They will weigh from 500 to 600 tonacaptecs. Ninety-two separate leaves will be ra-quited for the entire canal, their total weight being 31,000 dons, which is about the amount of steel that was required for the construction of twenty miles of the New total formum of steel needed to build the Manhattan Istelds over the East Riter.

total amount of steel needed to build the Manhattan Bridge over the East River. No vessel will be allowed to pass through the locks under its own power. Heavy electric locomotives will take the tow ropes from the vessels and draw them into and through the locks. Electricity also will be used to operate all valves and gates in the locks, the power being generated by water turbines utilizing the 88-frost head created by the formation of the Gatun Lake. Before proceeding to a description of the construction of the locks, it should be mentioned that Gatan Lake will constitution at the state of the source with the so

mensions. It will cover a total area of 166 square miles, and it will provide a depth in the ship channel varying from 85 to 68 feet.

It will be understood that the plant employed in the

By Walter Bernard
construction of structures of this magnitude called for
the exercise of mode insended thought in Its designs,
Where great masses of material are to be handled ft is
essential to cut down the distances over which they music
be moved, the number of re-handlings and the time consumed to ale ow a minimum as possibles for fu works
of this extensive character the labor cost is one of the
most serious terms. The plant at Getun is being used
for all the books. The locks at Pedro Migual and atdiling plants. They differ from that at Gatum in details,
though not in principle. It will be sufficient for the
present purpose to describe the arrangements at Gatum,
where over two million cubic yards of concrete must be
laid in place.

The crushed stone is brought from Porto Belle, a
small hambet about twenty miles east of Colon, on the
Allantic coast. The rock is loaded at the quarry by
steam shovels onto cars, which run by gravity to the
giant crushers, where it is reduced to the desired size.
From the crushers it falls the cars which run again in
Porto Bello to Cristobal, at the Atlantic attrance to the
canal, and through the old French channel to the docks
at Gatun. Here are located a huge cement shed, a

well. A ganued at the Missiones locks.

The construction of the shade of the whole of the two-responds to the whole of the first two-responds to the whole of the wh

Podro Miguel locks. The concrete mixers in base of crane towers leading a into buckets on flat care.

Gatun and unloaded by the cableways onto the sand pile.

The cement is shipped in barrels from New York to Colon, where it is transferred to barges, towed through the old French channel to Catun, and unloaded and stored in the cement shed. The latter has a capacity of about 20,000 barrels. The rock and sand storage believes the content of the content barrels and the rock pile of the content had and the rock pile of the cement and and the rock pile of the cement and and the rock pile of the cement and and the colon pile of the cement and pile of the cement and pile of the colon pile of the cement and pile of the colon pile of the cement is picked up by the bolistic and transpecting goar of a series of large cadeways, each with a span of 800 feet, which each of the cement is picked up by the bolistic and transpecting goar of a series of large cadeways, each with a span of 800 feet, which reach calling accounts to the point at which the concrete is in the carried to the point at which the concrete is in the carried to the point at which the concrete is in the carried to the point at which the concrete is in the carried to the point at which the concrete is in the carried to the point at which the concrete is in the carried to the point at which the concrete is to be demanded.

dumped.

After the floor of the locks has been laid and has set, the walls are erected between large plate-stad forms, which, for the inner vertical walls, present faces swer 50 feet wide and about 80 feet in budgit. These forms re built as morable stever giventures, and they cais he shifted from point to point us the fullding of the walls.

progresses. The topographical and office conditions is the Fedro Mignet and Mitistores Iodis on the District State of the Fedro Mignet and Mitistores Iodis on the District State on the Children State of the Condition of the Con

s of a tower 80 by 40 feet us that extend well over the storage piles. Two and tendental entitle yard bedreen, supported and operated from trolley frieds on the capitalerer treaties, pilet up the sand and stone from the storage pilet and the tendental the treat towers. Bessett the cuant towers. Bessett the chain towers. Bessett the chain towers.

sure. The chamber cranes consist of a tower \$6 by 40 feet, carried on trucks which run on tracks laid on the floor of the lock, Each the floor of the lock. Each tower supports a cantilever arm 83% for t long, extend-ing over the center wall, and one 81% fost long reaching over the side wall. A gen-erally similar plant is being used at the Miraflores loader.

By Newton Forrest

CONORESS about a year age repropriated \$100,000

Offer ordinance development in the navy. This sum held a string tied to it, however, in the shape of two conditions which were to be compiled with before the fault would become available. The first condition as specified by Congress was that the navy was to demonstrate that pre-juctifies, stred. Treat ca high-powers article spik reposition possible the heavy tarrest and best samper of a warship at bettle range; the second provided for an experiment to demonstrate the effect of 100 pounds of explosive galatine emploided in unconfined charges against the heavy turrest and best samper of a warship.

to demonstrate the effect of NOP pounds or exposure as the explosion in monthed charges against the loss terrest and belt emport of a vessel. These two tests have been curried out, and with an attrictory results that the navy now gain its 18000 for ordunate development. The two tests have been consistent and the experts, probably for sense and condition first or the condition of the waters in Ataqueton, Readle, where a weekle tom of the waters in Ataqueton, Readle, where a weekle tom of the water in Ataqueton, Readle, where a weekle tom of the water in Ataqueton, Readle, where a weekle toward the water in Ataqueton, Readle, where a weekle toward the water in Ataqueton, Readle, where a weekle toward the two the condition of the water in Ataqueton, and the two particular of the damage, wrought by the arms glassic, will be carefully inside.

The test thefat the appellations of the dast considerate and the condition of the dast of the Ataqueton, and the straight was duty carried out on Patranay, and the considerate and the straight of the Ataqueton March of the Ataqueton Ataqueton and the straight of the Ataqueton Ataq

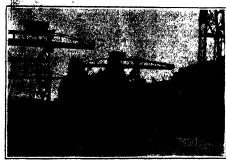


ok for the 2,000,000 cubic feet of co acrete at Gatun. Note



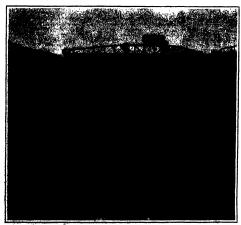
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Pedro Miguel locks, showing stock piles of sand and rock and two of the mixing cranes.

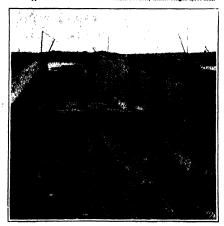




A finished upper lock chamber at Gatun. Width 110 feet, usuble length 1,000 feet.



Cantilover crunes, running on floor of locks at Pedro Miguel, place the mixed concrete in the center and side walls.



chamber. Gatun upper locks, showing the gate sills. The east chamber.

THE PANAMA LOCKS (5,000,000 CUBIC YARDS) ARE THE BIGGEST CONCRETE WORK YET UNDERTAKEN

ored some 8,000 yards—about five miles—distance the "Eslishasee." The targets were of the most t type of shell-resisting armor plate, representing armst and held former of a modern battleship. Flour shells fired hit and pierced the plates completely, her browing that for a while, at least, the gur is

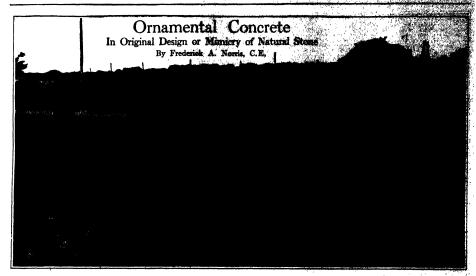
or three of the first shots being merely "finders." The ram "Katahdin" was not damaged.

It is now up to the armor experts!

Progress of Marine Oil Engines

Progress of Marine Oil Engines
IN the annual report of Linguis Register, recently islauch, reference is made to the use of internal combustion engines for marine purposes. With this type of engine there is considerable difficulty in effecting the reversal of the direction of rotation of the engine, and
when these engines are used for marine purposes the
attern motion of the strew has usually been obtained by
the use of bothed wheel gearing. Comparatively recently
there has been a development in the Direct and engine formarine work. A two-droke cycle has been successfully
adopted, and the reversal is effected in the engine first,
the crank shaft being directly coupled to the screw shaft,

The Diesel oil engine is now being fitted to three fourly large vessels being built on the Continent undo its supervision of the surveyors of Hogyle Renaries C mo of its being constructed on the older principle of the four-stroke cycle with single-acting cylinders, and will be of about 450 indicated horse-power. Another set is being made on the two-stroke cycle, also single-acting, and is insteaded for a twin-screw vessel, the power being about 500 indicated horse-power on each shaft. The hird set is being made on the two-stroke cycle doubte-acting system of the control of the control



C EMENT concrete has been used ornamentally only within the last firty years, and only during the last trenty has it heen used to any considerable extent. The dull gray textureless monotony of its surface prevented the control of t

practically every place where the other materials are now employed. It can also, if desired, be made to look so much like quarried granite, limestone, or sandstone as to dereute even stone cutters. In the case of the control of the made of concrete. As a matter of fact, they were In-

diana linestone.

Ahout a year ago one of the best known firms of architects in Boston was employed to draw up plans and specifications for an addition to a group of buildings also in Cambridge. The base-course steps and buttresses of one of these buildings were built of a stone very samilar to Milford pink granife and the architect desired to use this same stone in the proposed new building. They made a careful examination of it, but failed to recognise it as having been taken from any local quarry, and as they did not know where to obtain it, they used Milford pink granite instead. As a matter of fact the stone was concrete.

granite instead. As a matter of fact the stone was concrete.

Some manufacturers of ornamental concrete were requested by a large railroad corporation to see how near they could come to matching Cheimsford granite. The railroad had built must be likely piers of this stone which are the stone of the stone of the stone which the stone is the stone of the stone of the stone which the stone is the plant of about 150 feet each, and they wanted the arches themselves exclusive of the spandrels, the curbing balantrades and quoins, to match this Cheimsford granite. After some experimenting, a piece of concrete was produced and placed by the side of a piece of the natural granite. The chief engineer of the road, the president and the architects of the bridge, five men in all and all highly trained, examined the two stones at a distance sawy of from three to five feet and were saked to pick out the real from the artificial. Two of them were right in their gness, two of them wronig, and the fifth man declined to subsuit himself to the tests. Now Cheimsford granite 46 one of the most beautiful building stones in America. It is light in color, but sort and mellow and

warm. It gives the feeling of strength, durability and dignity, combined with modesty, for it is never garish or flaunting. University Hall at Haryard College, one of the most beautiful buildings in New England, was built of it by the celebrated coinnial strethest, Buildinch. It would appear, therefore, that if concrete can concerte can be used to cover a much larger field ownementally than heretofore, provided it is as good a material structurally in every sense, is economical, and last, but by no means least, that the uniformity of the product can be depended upon.

Two of the secompanying illustrations show how closely concrete can be made to resemble satural grantle in appearance. They are views of the new favored to the control of the contro he right is concrete. In the new U

the right is concrete.

In the new Hotel Kimball at Springfield, Mass, all the stone used is concrete, resembling in color and feature grantle and Indiana limestone. The entrance to the hotel is shown herewith.

In the accompanying illustration of the charch of fit. Mary immaculate of Lourdes, at Newton Upper Falls, Mary immaculate of Lourdes, at Newton Upper Falls, Mary immaculate of Lourdes, at Newton Upper Falls, the control of the Co Mass, all the stone work shown, including columns 48 feet high with their Continian capitals and even including the ornamental figures with dark red background in the typenaum, is of concrete. Attention is called to the understand the continuation of the continuation of the continuation of the continuation of the capitals to the extent, as water would be appropriate to freese in them and crack them off, but the beach places being made of concrete, it was possible to revenence this objection by inserting steel relative to except a capitals to the capitals of the capital capitals of the capitals of th

this material, concrete has been proved and in this representation, controlled to the provided and in this representation over a last some advantages over quarted; shows it is smoot fire treasting, more water-proof these spins of the most piscular building strains, and much less smitled has disablegration than some is sufficient in a time of the most provided advantage of being reinforced with steel, giving it greater strength in tension. This last advantage is important in the case of a stone need as a linted over a doorway or window, or aupporting a load over any opening, because if it should reach or the case of the cas

Whether the artificial stone is someonical or not largely a matter of location, but it most seems to the seems of the seem

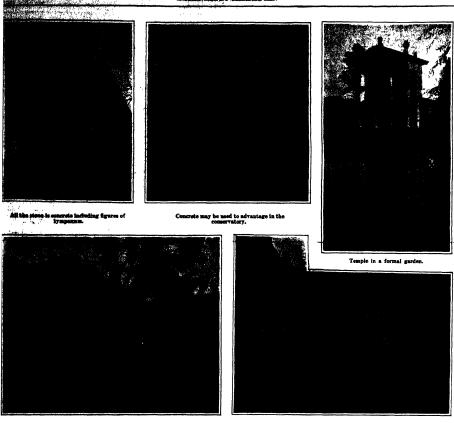
stone upon which the buildings themselves sent. This is a case of "carrying coals to Newcastis" with a vanegeance.

On the other hand, the writer was called upon last
summer to advise a man in reference to building a summer bous on some rocks forming a point of land projecting into the ocean. The owner varied the summer
house on some rocks forming a point of sand projecting into the ocean. The owner varied the summer
house on some rocks forming a point of sand projecting into the ocean. The owner varied the summer
house has been complexed and the building manife, it
and considerably changer had it keen built or rishless manounty from stone easily obtainable on the afte.

That the unitroraity of the product cannot generally be
depended upon is one of the great stumpling blocks in
this, path of properses in the use of concrete. Its prepart singulativities requires trained, shilled man of breate
under the most careful and paristaking rupervision. This
is a contrary to the general builter of the larguess, who is
other mades the impression that the finest and most earlform shome can be preduced by simply mixing sreahed.
He way prescribed in some healt on the subspectation
ing the mix in the form, and after it hardens, something
the form. Nothing could be further from, the traplate. The crashed stone of going the subspectation
in the formation of the first produced the subspectation.
The crashed stone is one page to subspect the
form this produced the subspect of the sense in the
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arty, which to itse and which not to, great with
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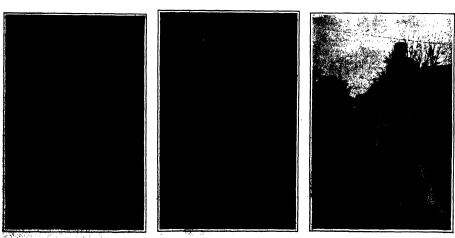
material.

But without going into the mailtest any further it is lepted is sufficient description of the function of supporting proper skill in the mailten and partial explanation of the makers for an enemy and as much condemnation in which present the exhibit in the condemnation in which present the exhibit in the large large and as much condemnation in which present the exhibit in the condemnation in which present the condemnation is which present the condemnation in the condemnation in the condemnation in the condemnation in the condemnation is a second to the condemnation in the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation in the condemnation is a second to the condemnation in the condemnation is a second to the condemnation in the condemnation in the condemnation is a second to the condemnation in the cond



Addition to Gore Hall, library of Harvard College.

An imposing approach, showing the adaptability of cement,



On the left, Spainey granite; on the right, concrete.

Unique watering trough and lamp post,

BANKS STAMPLES OF GENARENTAL CONCRETE AND IMITATION STONE



The Returns

HE response to the referendum made the week before last has been very gratifying. The Editor wished to know whether Handy Man's Workshop should occupy two valuable pages of the Scientific American every two weeks, or whether he should return to the old schedule of running the Department but once a month, and he put the following questions: Does Handy Man's put the following questions: Does Handy Mans Workshop interest you? Do you find it of real practical value? Do you wish it were conducted differently? So far, Handy Man's Workshop has received a hearty indorsement, and not a single voice has been raised against it; but the returns are not yet all in, and the polls will not be closed until mand leaves number of readers has been heard a much larger number of readers has been heard from. Do not fail to record your vote. The Editor will not be satisfied with anything but an overwhelming majority. Address Handy Man, Scientific American, New York.

A Home-made Valve Grinder By F. E. Keller

A SIMPLE valve grinder is easily made from an old bit shank and a piece of metal about 1/4-inch thick. The shank should be saved down through the center, the ends bent apart, and a hole drilled through the two parts, as shown in the drawing. The head or cross-piece can

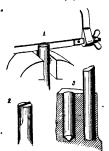


ome-made valve grinder

be made of suitable size to fit the valve, with the hole drilled so that the joint will come as close to the valve as possible. Rivet the two parts together as indicated and you will have a handy tool to use in a brace. The valve receives the pressure in its true center, so that a very smooth cut is obtained.

Squaring the Bottom of a Drilled Hole

D RILLS are usually pointed and leave a conical de-pression at the bottom of the hole. To be sure, the point of the drill may be ground down, but this takes time and shortens the life of the tool considerably. If you have not a reamer of the proper size, the quickest



Hastily-constructed reamer.

and easiest plan is to take a round piece of machine steel that will just fit the bole that you have drilled, say three-clights of an inch in diameter. Square off once end and with a thin hack say make a saw cut in it, as in Fig. 1, to a depth of tries-clighths of an inch. Then take a piece of ordinary clock spring and drive into the saw cut lightly. The clock spring should project from the end of the round steel about one-stateenth of an inch. as in Fig. 2, when ground off. The sides might be left one-hundredth. The same cut is stated to the same cut in the same cut

ting edges, if you skette to make the hole smooth its walls. The chick garing steet will work in six to three-quarters of an inch. A larger diameter require thickers metal. A small nick can be fitted the sides of the resoner just in front of the culture of the resoner just in front or the culture of the sides of the resoner just in front or the culture of the sides of the same region of the sides of the s

Shortening Machine Screws

On some work the workman is required to shorten out to work the workman is required to shorten not enough to bring the hack see into play. The file is the only tool. The round-work the could be the country tool. The round-work is the country tool. The round-work is the work of the country tool. The state is the country to the property of the proper

the appearance of the

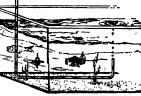


Aerating Apparatus for a Fish Tank By John Y. Dunlop



Acrating Apparatus for a Fish Tank
By John Y. Dunlop

AVERT simple device for driving air bubbles into a
fish tank can be made as shown in the accompanying
drawing. Pisce immediately above the fish tank a small
support of the state of the state of the state
and of the state of the chamber of the state of the chamber file a bole; fit each
upper cork pass a short length of glast of
the siphon tube by site of the chamber file a bole; fit each
upper cork pass a short length of glast
upper cork pass a short length of glast
the siphon tube by this with the end
to state of the chamber file a bole; fit each
ing. On this rubber tubing mount a
regulator, which will govern the amount
of water flowing through the siphon tube.
The regulator may be made of two small
plecos of wood avranged to be clamped
together by means of a pair of screws,
so as to squees the rubber tube, and
thus reduce the flow of water through
it. Through the lower cork of the air
the bubber of the tube
the state of the tube
and the state of the tube
should be slightly fared, to form a
fruncel-shaped mouth directly under the
upper tube. In operation, the regulator
should be adjusted to cause the water to



Acrating apparatus for a fish to

drip slowly from the siphon. The dropping water will fail into the mouth of the lower tube, and the sir between each drop of water will be impressed within the tube. The alternate drops of water and air spaces will then travel through the tabe to the fash tank greading through the water of the fish tank and thoroughly searting it.

Shop Notes

One Cause of Difficult Welding, —Has any mechanic ever tried to well a stay-rod or sone ordinary sain job, and found that the pieces supply stateous out willings together, but as though a thin film prevented this union? If no, he should have gone on a still must though not been probably found, that the signs a thin film prevented this union? If no, he should have gone on a still must thus some brother, succleant about the shop, and he would have probably found that the signs and he so making his soldering opper at the forge. Such work guide, a quietum, on welding every time, suntil the coals and since the sunding every time, until the coals and since newed from bottom to tog. The trouble fit smaller is, said exasperating lies of time.

Soldering a Redistate, —The removal of one applicability radiator to permit of soldering may be distated by the

Removing Stud-bolts Without as All By R. C. D.

STUD-BOLTS are often lated to remains, stati visions. Such as a subject to the control of the co



ods of fixing stud-bolts for easy r

large enough for the belt, which is to be removed, to pass through it easily. A tapered slot or key-way is then cut in one side of the nut, as shown, and a wedge-shaped key of hard steel is made to fit samply into it. This nut is then placed over the plain part of the stud-holt, the key is driven home and grips the bolt firmly, thus when the werealt is applied it cannot slip and the bolt can be removed with but-little or no dafaguration.

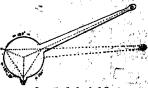
Handy Pipe-puller By H. T. Peterson

IT often happens when driving a well that the pipe breaks, making it well that the pipe breaks, making it of the well-driving mechanism is expensive and worth recovering. Not one ago, in an emergency of this kind, it occurred to the writer to device a simple pipe-pulier. The device was constructed as shown in the accompanying engraving. A piece of was a sample pipe-piner. The device was constructed as shown in the accompanying engraving. A piece of companying engraving. A piece of the pipe of the pipe of the pipe of the pipe of the pipe. The was procured, and found into was secured, and formed into a wedge that would apread out the allt end of the pipe. This was made fast to a rod of sufficient length to run up to the top of the pipe which was to be pulled. The upper end of the rod was threaded to the pipe which was to be pulled. The upper end of the rod was threaded to the pipe which was to be pulled. The dark of the pipe which was to be pulled. The dark of the pipe which was to be pulled. The dark of the pipe which was to be pulled. The dark of the pipe which was to be pulled. The dark of the pipe was drawn up, processing the pipe lippe so that it jeamed against the lower end of the pipe that was being driven, and thereafter the pipe was drawn up.



Suggestion for Foundry Ladies By M. W. G.

E VERYONE who has wetched the work in, a foundry must have noticed the strain on the messels—of, the men, while trying to bring the ladle with Reviews, Gastron to a sufficiently horizontal justition to, might be mobile metal run out of the pope. If the apout, were disposed at an angle of 130 degrees, the halddlesses in the accompanying forwing, instead of typing at an angle of



so engrees, as a generally does, the ladies on charged without any story. Any one can statement by filling a common assessment by water, and then, while bolding it by the la-hand, tyring to pour the water and, by the lay hand, tyring to pour the water and, by the lay to from day reader to let this water the at about 100 degrees from the handles.

Science in the Current Periodicals

In the Bepartment the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

The Company of the Air by the Chemist
I it is effortial column of Metallurgical and Observation of Metallurgical and Observation is the Column of Amountain although the Observation in the Column of Amountain in the Column of t

by exercised processes is makes the super-to-the characteristics of the processes and the sarry and isolated experiments, the endeavier of the chemist to transform the inert elemental nitrigues in atmospheric air inho some nitrogen composited of commercial value has extended on a systematic basis and on a relatively large scale over a little more than the hart decade. The more we learn of the different processes—differing essentially in the type and dasfign of the are furnace employed—the more it appears that with respect to the yield of grammas of fact nitrogen in form of HNO, per kilowatt-bour there is not most choice between them; little if any progress has little into the processes are differed to the processes are differed to the processes are alike. "But progress and to very astendible principle all the processes are alike."

not so very astemishing sloce in the essential principle all the processes are alike.

"Sut progress has been made in raising the concentration of MO in the gas mixture which issues the furnace, and very much progress in simplifying the design. Without making any invidious comparisons, the enormous advance made in simplifying the construction is evident; tiks ment that the expression in deliars and cents in the first cost of the plaint. How happens that the first cost of the plaint. How happens that the first cost of the plaint was the progression of the plaint of the progression of the progression of the plaint of the progression of the plaint of the p

binds some 10 grammes of nitrogen in 10rm or cyssismide. Naturally such a comparison, though interesting,
is quite one sided.

The a recent discussion before the New York section
of the American Electrochemical Bociety Dr. M. Leeb
pointed out that as the formation of NO from air at the
temperatures of the arc represents equilibrium, the
attempt should be a second to the second to the second to the
tempt should be a second to the second to the second
to the second to the second to the second to the
in order to re-establish equilibrium new NO would be
formed, etc. Dr. Whitney pointed out that such absorption might be very difficult at the snormous temperature
of the arc. Yet the principle is plausible. In Haber's
synthesis of samonias—another instance of fixation of
atmospheric introgen—such absorption is carried out and
makes the process really practical. But here we work
in the cold and absorption is comparatively easy. Clearly,
the whole subject is in a state of evolution. It was first
rigorously attacked by electrochemists with their inhorn
insargent spirit. It is now being taken up by conservative business men. Such a combinasign must prove invenicule in the end."

A Demonstration of the Possibility of a Hygienic Milk Supply

A Demonstration of the Possibility of a Hygienic Milk Supply

Many conditions injurious to the public health are distill maintained through thoughtless adherence to traditional practices, but this evil will be gradually abated as the labors of the men who have deroted their energies to the promotion of hygiene become more widely known and appreciated. This result will probably be promoted by the International Hygiene Exhibition, which will soon be opened in Dresden, and at which, according to Hygien, the official organ of the collision, the question of military to the collection of the control of the collection of the collection of the collection of the collection will be expectedly interesting because it will show how well science and commercial industry can work togethese in this field and will demonstrate the practical highest and the collection of the collecti

difficulty be remedied. Hence hygienists demand the introduction of asspite methods to an extant which appears accessive, at first giance, but which is so practicable that it is already in practice in many model dairy forms, as will be aboven by instructive models and photographs. Although it is impossible to exclude germs as completely in the dairy as in the operating room and the bacteriological laboratory, it is possible, even in small establishment of the control of the control

bacterial containation to a minimum.

These exchanges are from the many of the second containation to a minimum.

These exchanges are second contained to practice and to prove that hygeinic reform rather increases than diminishes the profits of the milk business. The small farmer who keeps one or two cows will derive particular benefit from the exhibition of improvements, which have stood the test of experience, in stable construction and equipment. There will also be an exhibition of sterilising appliances and a demonstration of the alteration produced in milk by sterilisation. Many of the germs in milk show astonishing vitality and resistance to bacterial signsts, but radical and violent sterilising processes generally injure the quality of the milk.

The problem is to avoid the evils flowing from this source, such as "Barlows' disease," caused by feeding the fants with milk boiled too long, and yet to destroy the bacteria.

bacteria.

Finally there will be an exhibit of improved methods and appliances employed in making butter and cheese, and demonatrations of the nutritive and pecuniary value of these and other milk products, including the commonly unders: thingsted skim milk. In this section it will be shown that although bacteria are generally injurious, certain bacteria are very metal in the production of kumyas, kefir and other valuable milk products.

Artificial Diamonds
THE fact that diamonds are simply crystallized carbon was discovered by Levoister and Sir Humphry
Davy 140 years ago. Davy attempted to produce artificial diamonds by piating harcoal and graphite (which
is another crystallize form of carbon) between the poles
of powerful galvanic batteries, but obtained only fused
masses of the silicates which the charcoal contained.
In 1889 Liebly wrote to Worher that he had succeeded
in making diamonds by crystallizing carbon from an
aqueous solution, and promised to send Worlder an artifield diamond as thick as his thumb, but there is no
record that the promise was kept. Liebly asserted that
minute diamonds could be seen glistening in sunlight in
common charcoal.

Other experimenters claimed to have produced dismonds by decomposing a solution of phosphorus in cashon disuplied and by hesting charcoal in the electric are, but these claims are merely examples of the mistakes which abound in the history of every science. Artificial diamonds were, possibly, first produced in the seventies of the last entury, by the English chemist Hannay, who obtained small crystals, said to possess the form and hardness of diamonds, by hesting petroleum hydrocarbons and mitrogenous hone oil with metallic obtained diamonds by hesting silver technoloud in a meas of charcoal. Both of these claims, however, are disputed.

abblished diamonds by besting silver inclosed in a mass of charcoal. Both of these claims, however, are disputed.

The first unquestionable success was obtained by the French chemist Henri Moissan by a very ingenious and rational process, based on a study of the conditions in which natural diamonds are found. Moissan's chemical researches had proved that diamonds often contain in-partities, constating chiefly of Iron and allicon, and he discovered microscopic crystals, which he recognised as discovered microscopic crystals, which he recognised as discovered microscopic crystals, which he recognised as delicor, and he discovered microscopic crystals, which the great pressure produced in the interior of the unsteorite by the formation of a solid crust, while the inner portion was still funds, had caused some of the carbon dissolved in the meteoric from to be depolated in the crystalline form. In order to test this theory Moissan invented an electric furnace, constitug of a block of limestone, hollowed out for the reception of a crucible, and provides in the interior of the furnace produced a temperature of about 6,500 deg. F. Moissan employed a crucible of carbon, which was filled with a misture of iron filings and pulverized charcoal. After the contents had been fused the crucible was cooled by immersing it in loc-cold water. This sudden chilling converted the from in contact with the wall of the crucible into a solid crust, which imprisoned the hot and liquid mass whiles. As from expands in solidifying, the greatest cool, produced an enormous pressure. After the centire mass had become solid it was disacter of 1/54 inch.

Fisher modified Moissar's apparetus by placing beneath the furnace & vessel of weath. The sudden children could be instantly dropped. This increased the suddencess.

An article in the Technische Monotabelis, from which these facts are gieaned, adds that Fricialender and Von Haaslinger have come to the conclusion that a genetic connection must crist between diamonds and the rock in which they are found. These chemists succeeded in producing introscopic diamonds, 1/28000 inch in diameter, by fusing olivine with charcon By substituting artificial olivine for the natural mineral and effecting the fusion with the and of thermits, they obtained larger crystals. None of these artificial diamonds, however, exceeded 1/200 inch in diameter, so that this process, like Moissan's, possesses no practical value.

Sir William Crookes, in experiments on the explosion of cordite in closed vessels, in which a pressure of 8,000 of condities in closed vessels, in which a pressure of 8,000 atmospheres and a temperature of 9,570 deg. F. were attained, found minute crystals of carbon in the residue left by the covidie.

left by the cordite

sert by the cordite.

These are the simple facts in regard to the artificial production of diamonds. The problem was solved theoretically by Moissan, but it has not yet been solved practically, because the diamonds produced are too small to have an appreciable commercial value.

Pragmatism in Science

I N a recent number of Science Prof. Sedgwick Minot refers as follows to some of the metaphysical questions which arise with regard to the fundamental assumptions

which arise with regard to the fundamental assumptions of science.

"Scientific men base their work upon a series of assumptions first, that there is absolute truth, which includes everything we know or shall know; second, that the control of the

Let us acknowledge the belated compliment and continues on our way.

"The practical result of the four maxims has been that we further assume that all errors are of individual human origin and that there are no objective errors. We make all the mistakes, nature makes none. To render the pursuit of new knowledge successful our basic task is to cliniants error, or in other words to decide when we have sufficient proof. The elimination of error depends prince methods of all sorts are employed, involves an intimate technical acqualantane with the methods, with just what they can show, with what they cannot show and with the insleading results they may produce. In the laboratory training of a young scientific man, one chief endeavor must always be to familiarish in with the good and the bad of the special methods of his branch of science. Not until he thoroughly understands the character and excupalitied to begin independent work. His understanding must comprise the three sources of observational error, namely, the variation of the phenomena, the imperfections of the methods and the inaccuracy of the observe. The personal equation always exists, although it can be quantitatively stated only in a small minority of cases. "We think of science as a vast series of approximations closer to absolute truth, the existence of which best we may treating them in large part and at least for the time being as if they were accurately true, yet mean-while we remain alert to better them. This has long been the standard of scientific thought. It is the pragmatic activities of mind, but its new name has not rendered it a novelty."

A Ticket-making Machine

A CCORDING to the Regineering News a ticket-making machine has recently been installed by the Long Island Raliforad Company at its Platusha Arenue station in Brooklyn, N. Y. The machine was manufactured in France, where a number are asid to be in service, and is the first one of its kind to be used in America. By its use the ticket agent can in a few seconds make a ticket between the issuing station and any other point on division. Besides the two stations the ticket also dependent upon the class and destination. Four classes of tickets may be issued, whole fare one way or excursion and half fare so make the proper the states of the way of the machine. These are set by the operation, the pathes a lever which beings the plates into position, a small electric motor then completes the operation. It is said that the machine is so satisfactory that others will be installed.

The Inventor's Department

Simple Patent Law; Patent Office News;

Inventions New and Interesting

Unsinkable Fishing and Lifesaving Boat

IT IS NOW some nine years since the Anthony Pollack prize for life saving apparatus was offered, but hitherto no award has been made, although many competitors have submitted vertous devices in claim of this prize. None of the inventions submitted were deemed worthy of the recompense by the judges. The reason for petitors have submitted various devices in claim of this prize. None of the inventions submitted were deemed worthy of the recompense by the Judges. The reason for this mo doubt lies very largely in the fact given to be a submitted with the recompense of the recompense by the Judges. The reason for this mo doubt lies very largely in the fact giner to design a four thin states the vary rigorous conditions laid upon the craft designed for these very special purposes. An attempt to solve the problem, which appears to present some special merite, has recently been put forward by M. Pitter. It is designed to fuffill a double function, namely, in the first place to serve as a life host, and secondly, to take the place of the ordinary of the second the second to the second the ordinary of the second to the second the ordinary of the second to the second the ordinary of the second to the secon

compring hat very little space on board the vessel.

The endeavor has been made to replace these boats by some safer type. With this end in view M. Pitre has adopted a shape essentially similar to that to which the flaberance are accustomed, in the hope that they may be the more resulty induced to adopt the new model, even though a somewhat they may be the more resulty induced to adopt the new model, even though a somewhat they may be the more resulting to the control of the contro vessel.

The endeavor has been made to replace

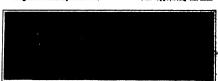
the food, there being a set of portholes in way as the portholes on the upper side of the bottom of the boat, communicating with beat. Thus food, water, and clothing the four compartments in about the same can be drawn from the boat as occasion



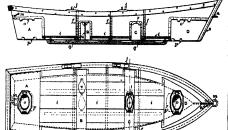
The new and the old form of boat, showing the general similarity of the two.



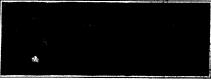
The old form of best when capsi would support only one man.



The boat in its normal positi



Longitudinal section and plan view of the new boat, showing the watertight air compartments A, B, C, D.



View of the capsised h boat, expealing the portholes the gained to the food and water.



of and the own of they properted on the UNIDERABLE PROPERTY AND EMPEROUSE POAT

. It has

h of William L. Aughin-

a baugh, former Frincipal Resember of the United States Patent Office, back place at Monrovia, California, February 19th, 1911, to which town be came in hopes of regaining his health after resigning from

regalating his health after realgating from the government service over four years age.

Mr. Anghinbuugh was born in Shippensbrug, Ph. April 19th, 1966, and learned the printing business. A mere boy at the existence of the Criti Wax, he smilested at Charlowship of the Criti Wax, he milested at Charlowship of the Criti Wax, he milested at Charlowship of the Critical Wax, he milested at Charlowship of the Critical Wax, he was a transferred to Company I of the same regiment, being honorably discharged from the amp Jame 19th, 19th, at the close of heatitities, The was wonded at the business of the Critical Wax, and the close of heatitities, The was wonded at the business of the Critical Wax, and the way of the company with his regiment between the company with his regiment between the company of the company of the Critical Wax, and later cause to Washington as an employee of the government printing office. He took the Critical Wax, and later cause to Washington as an employee of the government printing office. He took the Critical Wax, and later cause to Washington as an employee of the government printing office. He took the Criti Service exassisation and was appointed to the Peatent Glüce, where he served thirty years, three as law clerk and atteen as Frincipal Resminer. Being a graduate of law, he was also & insuber of the Supreme Court of the United States.

Brief Notes Concerning Inventions

Brief Notes Concerning Inventions
Patents at Sea.—While, ordinarily, United States patents extend only throughout torritory under the jurisdiction of the United States, they have a further force in that they extend to United States ships to the same extent when they are on the high seas as if they were solid on United States territory. Also the manufacture or sale of a patented article on board a forcing ship while in a United States port would in-fringe a patent for such article, atthough the more use of the article on such fersign ship would not likely constitute an infringement of the patent rights.

The Stepensions Value of Trade-mark Rights.—The attorney for a large north-western milling corporation told the writer his company would spend millions in defending its trade-marker; the mensager of a p-tent medicine concern, based on a trade-mark and capitalised for less than \$83,000, said his company spont \$1,000 per large day advertising, and the atterney of another peater medicine concern whose residuation that the content of the content

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NOTICES

observed. Subjects to the probable patenta-investion will be readily given to any rusishing us with a model or shetch and adjution of the device in question. All situes are attrictly confidential. Our set on Patenta will be sent free on

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marker if possiols. * Pactory," Drawer 8, Totedo, Oilol Rad T. 18 VENTIORS WATER 1 will consider the purchase of one or more investions, broadly protected by patents allowed or applications on which broad ciains bary been granted. Only inventions with broad commercial constitution will be considered and prefer-ciant waterials or patent appending trades. Give full des-cription. J. P. 5, P. O. Bure, Rayade Long plasso, N. Y.

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engineer can open and close soving train, by electricity. W. F. Bath, Blabon, Artsons.

THE a manufacturer for my powly patented toy size. For particulars see this paper, lump Address: Geo. A. Weimer, Savannah,

OUNCELETTE LISTS of manufacturers in all times supplied as short notice at motionate (since final) and posterior process to complete to refer at various prices. Manufacture prices to complete to refer at various prices, to consider the process of the control of

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the Re. States. - Wanted to buy me Inquity Wa. 6804. Wanted, to but a machine for inquity Wa. 6804. Wanted, to but a machine for inquity and an inquity of the second of the link they No. 1812. Wanted, to but a most of trees or wanted on machine. dry No. 9206. Wanted, a concern able to

bry Ho. Wanted, of treeses of manu to the best of the best of contents of the west bording alloy can be played to the best of the best of

Con Maria

RECENTLY PATRICTED INVESTIGATE

These columns are open to all patentees. The notices are inserted by special arrangement with the laventors. Terms on application to the Advertising Department of the SCIENTIFIC AMBRICAN.

sokly Index of Patants issued by the United Patent Office will be found in the Scientific can Supplement.

Pertaining to Apparel.

Pertaining to Apparel.
ARCH SUPPORT L. Invariet, New York,
N Y The oldect here is to provide a support
for boots and shoes arranged to permit of conveniently placing it with a view to properly
support the arch of the foot without producing discomfort while waiting or resting. Use
is made of a pocker harring a beel extrasion
and a sustaining plate within the pocket and
at the inner side capable of following the in
step portion of the shee upper.

Electrical Bevice

Electrical Beviews.
TELEPHONE MOUTHURES.—Lot is
STRIMBRIGH. Breekly, New York, N Y This
tavention has for its more particular purpose
the improvement of the sanitation of the
mouthplees, and also to provide for increasing
its strength for rendering its various portions
readily accessible and for otherwise improving
its general difference. The desire contributions
for the strength of the sanitation of the
following places for bacteria and other
disease germs. The complete structure endoys
a minimum of absurpt corress, and the material
used in the mouthpleee finance perfect bracing
strength strength

strength of the Month of the Mo

Of Interest to Farmers.

Of Interest to Farmers,
ILANTER is F W Hanners, Ju, Hunker
IIII. III. The purpose of this inventor is to
provide a display and invegenate device,
adapted for attachment to the leg of any
panner, to take the place of the neutal ranner
which will cut a smooth and uniform
trench to receive the same and will cover the
seed after it is planted.

seed after it is planted MARKER ATTAINMENT. L. R. TINNEL Long PRO. Not This attainment is operable to the driving mechanism of the planter, by means of which the marker for indicating the positions to be everypled to row of plants or hills, can be automatically disposed into a plantilit of conditions operative and inoperative, in which the construction is supplied at the position of the position

Hardware and Tools.

Hardware and Tools.
RRSHLIKEY COMPOUND LEVEL W. V.
GLERET, Kings Chambers, Loudon, Kuginad
This invention relates to levers formed of
spring material and having lever arms and being
level party converting the love arms and relagive the state of the state of the state of the state
jetch to interal compression applied to its
ends the said arms are caused to move in alother direction, that is to say, approach each
other at their five unds, and shown such part
is released from pression, the device resumes,
or springs best to its aurms.

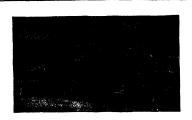
Pertuing to Mecreation.

Pertaining to Mecreation.

ARRIAL TO) —F A TRAIN, San Francisco, Cal. In the present protest the invention included in the control of the con



provided with plan, balls and a shooter. The collapsible books A and A' catch the plan and balls. In the very simple shooter the rod E a pulled back. A slight pressure at P will rouses it and send forth the ball with the accuracy of a bilactic plan with the ball with the accuracy of a bilactic plan and a plan and a that boat the balls gainly can be played on,



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DIVINE WATER MOTOR COMPANY

The Problem of Water (Continued from page 816.)

A number of special coatings for essent have recently been placed on the market, the makers of which all claim that they will successfully withstand the action of the alkali in the cement. It is the action of the kail in the cement. It is the action of the alkall in the cement which causes the de-struction of an ordinary linused oil paint, especially when applied to a new concrete surface. The waterproofing qualities of a number of these special cement coatings number of these special cement coatings are in many cases greatly overdrawn. Therefore, in selecting a peint the purchaser will do well to test it for himself. The simplest way to do this is to procure a fairly parous brick and give it as many coats of puint as near lintended to be given to the wall which is to be painted. (Two costs are always better than one, especially if a light color is to be used.)

coats are always better than one, especially if a light color is to be used.) brick is thoroughly dry, have it weighed and make a note of the exact weight. Then put the brick in a pan or pail, in which there is Just enough water to complete the light enough water to complete the twelve hours, and then remove for at least twelve hours, and then remove it and after wiping off all of the surface water again weigh it; and compare its weight with the weight before it was submerged. The difference in weight will alway past how much water went through the coating and was absorbed by the brick. Make an number of tests as described above with various paints, and the past of the water. Asket from the coirced coatings mentioned above there are a large number of as-called coloriess waterproof coetlings. These are intended for use where one wishes to riving the make the one to the same the substant the hards.

on the market.

These are intended for use where one wishes to retain the natural color of the concrete. They are also largely used as a preservative for limestone, sandstone, etc. Probably one of the oldest materials used for this purpose is the ordinary commercial parafilm. This is applied to the surface hot with a brush. Then the surface thus treated is subjected to heatt which opens the pores in the stone or cement, and allows the parafilme to enter into all of the small crevices and volda, thus sealing them up and preventing any further moisture from entering into the mass.

All the commercial water-proofing prep-

small crevices and voids, thus sealing them up and preventing any further moisture from entering into the mass.

All the commercial waterproofing preparations depend for their action on the principle of penetrating into the mass and filling up the voids. Most of them are sold in liquid form, assoline being used as the solvent and saturant. Care must be taken in the majority of them accomplish their object by the incorporation of wax and grease. Therefore, if they are used oxcease a most the majority of them accomplish their object by the incorporation of wax and grease. Therefore, if they are used when the weather is at all cold.

Aside from keeping the dampness from penetrating through the concrete, a good in the second of the second



And Then You Talk about Fireproof Buildings

No structure with an interior of inflammable materials ever was, or

ver can be, fireproof.

Replacing combustible materials with steel is not a luxury, not an adjunct "well enough let alone"—but a necessity for the absolute elimination of the fire hazard. The following excerpt from a letter from our Philadelphia office and this illustration carry their own arguments.

Williams.

"Under separate coner use one another you two photo-graphs, one of the module above filters fact out of the holistion does, sharing outs section affect the first and as the modes does, while it fill not outs take the name of year send does. Then, as you know, show the result of the few on the fifth flow of the Child's Building, 19th, and Chastack Shouth. Four does on the none leading to the elevator shall, yet up about a year ago."

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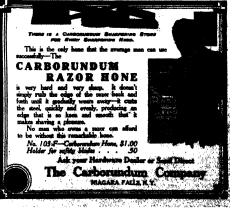


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A STATE OF THE STA

In Fig. 8 is shown the proper method of arrangement for the flashing and counter-flashing. The flashing is shown at a and it should be turned up against the parapet wall for a distance of at least eight to ten tocks. The counter-flashing, which prefer-shing is of metal, bould project into the wall as shown at b. It should start at well as shown at b. It should start at about twelve inches from the surface of the roof and should be allowed to project over the flashing to within about two inches from the surface of the roof. The inner section of the parapet well above the flashing should be given a good cost of waterproof paint, so as to protect it from the weather. This is important for if not done, water the superfunction of the control of the water water than the surface of the control of the wall. If the parapet wall is not too high the counter-flashing can start from under the coping as shown at A. Fig. S, in which case the waterproof coating may be ountted.

which case the waterproof coating may be omitted.

Very offen, in new work, the waterproofing course is extended through the entire thickness of the parapet wall, as shown in the company of the parapet wall, as shown in the control of the control of the parapet wall, as shown in the control of the control

incir composition is held as a servet. For the waterproofing of concrete awimming pools, tanks, etc. a course of tar and felt or apphalt and felt may be employed, using the same general methods for application as described for the waterproofing of foundations. If the tanks are well reinforced, so as to provide against expansion cracks, and a good rich mixture of concrete is used, the integral method of waterproofing, however, will produce good results. If leaks should develop owing to ansalt expansion to the state of th on the inside of the walls.

on the inside of the walls. In conclusion, it should be said that weather conditions, as well as thorough workmanship, have much to do with the dual efficiency of waterproofing. Better results can always be obtained in warm weather than in cold. So bearing this fact in mind, never have waterproofing applied in winter time, unless it is absolutely one.

The Coment Market (Continued from page \$78.)

Combined from page 212.)

LICENT VOCTOR.**

the "NACTOR That has been fined in the fined in the Land.*

The land the fined in the Land.*

The Land the La blast furnaces. This was in 1901, in which

The electric vehicle is the real pleasure vehicle of the present and the future. The electric truck is the commercial car of the age-because of

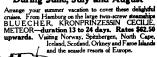
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that, and the result was a combination of eastern manufacturers who decided to keep that, and the result was a combination of castern manufacturers who decided to keep their territory to homeseves and to discipline the minor componies who had attreed up the trouble. So the Association of Licoromed Portland Cennett Manufacturers were considered to the control of the control

until retrusty Vi. 117, in the assessment dissanded on the thirty-day prior to the time it was shreduled to exhemit the time it was shreduled to exhemit the time in the property of the time it was shreduled to exhemit the time in the property of the prior to the time it was shreduled to exhemit the time of January they held firmly. Indications now point to a firm hand keeping the refractory companies in line so as to prevent them from plunging themselves into the abyas of failure. One factor in the early disbanding of this association was an adverse decision in the courts affecting the Hurry and Seaman patents under which there was an attempt made to claim that practically no natural Portland cement is made in this country. This case is still pending, and a final decision will help to clear the atmosphere in the whole trade.

phere in the whole trade.

During this period the cement companies
were hard pushed to find profitable business. The Pauma Canal work and the
Ashokan and Catskill dams, the Seshoard
Alr Line's rathway over the Gulf from the
Pforbida mainland to Key West, all took
large quantities, but the great need was for
a steady outlet taking small quantities at a
time, but large quantities in the aggregate
of a year's business.

of a year's business. The secret of success in the Portland coment findustry is to keep the entire equipment busy to its full capacity. This reduces cost of manufacture. The question then arose, "How shall we get this small business?"

It is a far cry from a sale totalling 2,000,000 barrels to the sale of a 100-pound long of coment, but the manufacturer is the former. To this business institut of the cement producers must be largely accribed the credit of baving created the improved American farm. Hers, then, is the required are outlet. It works out about this way. new outlet It works out about this ways. The farm used ris, each to be a delapidated place. Any old thing would do; a stick for a fence post, boughs for a culvert bridge, an old tim roof for a pigety and a shed for a cow barn. The farmer himself lived in a shantly, or a house without comforts, cold in winter and baking hot in summer. The culdays whitting clothespins at the country store and idly gossiping about his neigh-

bors.

To-day he reads in the free book of how cement may be used on the farm. He is convinced and orders a bag of cement from the general store in his town. He decides he will try the experiment of making a concrete frence post. He follows the rules in his book and be discovers how easy it is. Besides, he argues, "It puts my winter days to good use." Then he buys a barrel to build a ratproof corn crib and discovers how easy that he was a superior of the discovers how easy and how cheap the new-faugled how casy and how cheap the new-faugled. build a ratproof corn crib and discovers, how easy and how cheap the new-fangled idea is. Discharged farm hands cannot hurn down his barns at night because they are freproof. Sanitary concrete cow sheds make healthier cows that fetch more on the and inceptod. Sanitary concere own seeds make healther own that fetch more on the other are diminished or climinated, with accumpanying gain to the health of the horses. He preserves his decaying shade trees by the use of cement filing. The warmth afforded his chickens in their new concrete hen houses insures winter eggs, and soon he can afford a fine automobile for that concrete gazage he has been planning as a sort of farm luxury. His children can be taken ten miles to the nearest town to achool, instead of going to the district from the front gate to the frent door on a snowy white concrete walk and not through tout allow ledep. The nammfacturer consess in for his profit in this helping the farmer, by selling fifty carlonds of eenient to a small, lostiated country town in a single season, where he formerly sold from five to ian carlonds a year.

The book on how to make cement roads, that which tells how to make cement take-graph poles, and others which tall how to make concrete coal peckets, and so forth, graph poles, and others which tail how to make concrete cost peckers, and so forth, are all doing their work, bit the supply of coment is not yet on a level with consump-tion. The mills can make more than the people can use. It costs a great deal of money to keep a plant rauring. It is prac-tically rain to let the concern's organisa-tion disband. The plant must be operated day and night; week day and Sunday. To cool the little mean heavy losses, so they have the control of the control of the control of the little means heavy losses, so they have the control of the co

LOOKING TO THE FORMOX FIRLS.

American cement ranks with the best o
any other country, but American manufac
turers cannot place it outside of this coun

any other country, but American masurfacturers cannot place it outside of this country. The exports last year were \$9,300,000 barrelis. This is based upon a shipment by
one company of "a little over \$,000,000 barrelis" to the Pannam Canal. (The exact
figures are computed at \$,100,000 barrels.)
Touchnately, west to foreign ports. As the
Pannam Canal with an American operation on American soil, this company's shipment cannot be correctly classed as foreign
husiness. There are 105 companies in the
country, which gives an average of only
\$,900 barrels suport business for each Germany alone sent 99,714 barrels into this
country during eleven months of 1910, and
200,197 for the same period in 1909. The
value of the 1910 shipments totalled \$144477 and the 1909 shipments g807,934. Note
the difference in these values as compared
with American values.

with American values.

The imports of Portland, Pussolan and other cements during the eleven months of 1910 are shown in the following table:

1909 1910 Barrels, Value, Barrels, Value,
 Unit'd Kingdom
 6.584
 89.262
 20.364
 89.808

 dom
 . 6.584
 89.262
 20.364
 899.804

 Belgium
 . 65.112
 120.207
 116.002
 161.536

 Germany
 200.107
 307.924
 897.71
 424.477

 Canada
 48.342
 92.625
 61.93
 0,000

 Seattering
 34.781
 52.686
 22.345
 31.657
 Total ...385,016 \$582,654 270,618 \$866,556

ment ex-ported . 4,197 6,312 16,970 Net total 880,819 \$576 342 233,648 \$343,906 Decrease in imports during eleven months in 1910 over same period in 1909, 197,171

American exports should greatly exceed American exports should greatly exceed any of the totals for other countries. The German Portland Cement Manufacturers' Association has a membership representing 29,600,000 barrels for the country's output last year, with 98 registered factories. America had 103 factories last year, an concrete had 103 factories last year, an output of 74,000,000 barrels and an actual export business for eleven months of not more than 196,000 barrels.

Portland comments.

more than 180,000 barrels.

Portland cement probably never will advance above the present current prive at mill, but the cost of manufacture will be considerably lessened. This will come only increased capacity. If this increased capacity does not find an outlet the law of supply and demand will affect prices and cement will be cheapened to the home consumer at the expense of the manufacturer until he is forced to go out of business.

The One-piece House (Continued from page 277.)

(Continued from page \$77.)
type of house, but does not carry the high
quality that an all-concrete home does.
Its cost is low for small houses. Where sercral practically alike can be put up at the
same time costs have been obtained which
were nearly the same and in some instances
less than a fix-clisas frame house.
The construction of these concrete wall
houses is a matter of careful study and experimentation by small local builders, slight
by architects who are enthusiastic and interested in trying to do away as far as possible with the terrific fire loss in this country. Mr. Edison's much-taiked-of cast iron
forms for the werkman's home have not sry. Mr. Edison's much-telled of cast from forms for the werkman's home have not as yet been found practicable. There has mever been at Edison house built, and in the opinion of most practical concrete usen none ever will be built. The problems of handling concrete as proposed by Mr. Edison seem insurmoustable. The initial cost of preparing such a set of forms as proposed by Mr. Edison entails all tols, including contractor's plant, materials and adding contractor's plant, materials and all lay, about one handled and seventy-development of the property of the property



THE SERASTIAN IS-INCE &

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aflow lower hide on jobs a greater profit on the work. M

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Ideal Lawn Mower Grinde



great small bines of the straphest interior and substrate reassistant and offers an interior state of the straphest transfer and offers an interior state of the straphest state of the

Ornamental Concrete (Continued from page \$81.)

a building material to which it is en-

as a building material to which it is entitled when properly made.

Assuming from what has been said that
concrete can and has abmulated natural
stone very closely in appearance, and acsuming further that the appearance of naskral stones is plensing and desirable, it folloops that concrete has great possibilities
orizonentally, and we shall therefore take
up the matter of designing in this material.
Concrete is primarily a plastic substance
that is the property of t

and should be so considered in designing. It has its limitations and should not be used where another material would serve the same purpose and be cheaper. It can be treated exitatically to suit itself alone—as a particular material—different from brick or stone or wood, and this is the principle we must bear in mind in developing its attistic possibilities. A practical knowledge of its physical qualities and how to make if good, strong and durable and to work it economically in necessary. This requires a large practical experience and much time Laboratory experiments are often very miseconomically is necessary. This requires a large practical experience and much time Laboratory experiments are often very milleading, good examples being easily made and work on a small scale often impracticable on a large one. In centre exhibits, for example, concrete samples are frequentiable on a large one. In centre exhibits, for example, concrete samples are frequentiable on a concrete which cost a great deal more than supposed, and are of questionable durability when exposed to the elementar panels showing surface treatments most impracticable of reproduction on a large scale, some perhaps one foot square on which one of the elementary of the expectation of the expect Many or these "cries of the trace must be known. The writer has in mind the case of one of the largest rement manufacturers in the country that has made a practice for the last two or three that it was not been as the last two or three that it was not been as the last was only a case the same and a different "centent shown," examples of concrete products made of course of its own crement, and has carefully shown only work that was genuine and dyst could be produced actually in practice but it is doubtful if one out of ten persons who have seen these exhibits knew the difference or appreciated the honest and far-assing policy of the company in showing what was actually-practicable. Excluding lack of taste, most of the baddy designed structures built of concrete that are so cessions in this country, are the residue of ignorance, either of the possibilities of the majories.

Interestical Aviation Race for Bussett Traphy, "The date of the Sentett Aviation Race for the Bennett Aviatrophy has just been set by the Royal Glab of Creat Stretch," he see will in England, on Jame 60th, and will be A circular cours above an aero-Thi Glatance to 150 Minoscient Control of the Control of

Aeronautica

Geouting by Aeropiane on the Mexican Border.—The new Wright biplane, which was bound to the War Department by Mr. Robert Collier, was put in commission recently at Laredo, Texa. On March ist Aviator Parmalee took up a photographer, while Ideut D. B. Foulois made few secuting flights later in the day with the accounting flights later in the day with the Alfort McIntoh. From which point the 18-mile flight was made on March 3rd.

General McGreen for America.—A con-

116-mile flight was made on March 3rd.

Gnome Motors for America.—A contract was closed last week by Mr. Robert
Taylor, of New York, for ten Gnome
motors, to be supplied by the Societie
Gnome, of Paris, within a couple of months.
Mr. Taylor expects to use these motors on
some acceptance he is constructing, and he will also dispose of a number of them to
individuals. Thus is the first large shipmiddividuals. Thus is the first large shipmodification of the ship of the ship of the conAmerica, and it should result in some record flights by such aviators as are fortunate
enough to get one.

Sacconfiel Flights by Cartian's Milltery.

esough to get one.

**Rucceastal Plights by Curtias' Military
Puglia.—On March 3nd, four of the offrees of the Arny and Navy detailed to be
taught how to fly hy Glenn Curtus made
successful half-mile flights at \$an Diego.
Lieut. Paul W. Beck. of the Signal Corps.
led off with a holf-mile flights in a straight
line. He alighted, and then flew hock to
the starting point. Lieut. Part G. Philli
Co. E. M. Kelley, of the Thirteenth Infantry, also made smallar successful flights.

**A Rocced Coverage Flight.—The longest

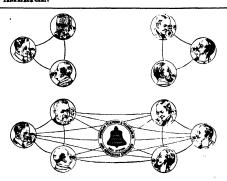
A Record Oversea Flight.—The longest and most remarkable flight ever made over water was accomplished by Lieut, Bagne (who recently resigned from the Fourth Al-(who recently resigned from the Fourth Algerian Riffes to take up aviation) on the 4th instant. Starting from Nice in his Bifriot monoplane at 750 A. M., Lieut Bagre headed for Corsice, but lost his way, and after flying continuously for 4½ hours, finally allighted upon a small rocky and wooded laind named Gorgons, lying between Corsica and Leghorn, Italy. His machine was holly damaged in alighting, but the young officer scaped without moury. The air lind datance correctle was about the view as great. It was Lieut, Bagnes kintention to fly entirely across the Mediterraneon to Algeria via the Islands of Corsica and Sardinia.

via the Islands of Corsica and Sardinia.

An Anghiblous Acceptane.—On Pelvinary 28th, Glenn H Curtiss made his first
flight at San Diego with his new biplane,
equipped with both a pontoon and with
wheels. He was able to start from the
land, alight on the water, re-start from the
land, alight on the water, remove again
without mishap. Now that he has accompliated this feat, there is nothing more to
be deared, since he has produced a machine that can be used on land, water, or
in the air. The acroplane was mounted on
a single scow-shaped pontou as before,
a single scow-shaped pontou as before,
as single scow-shaped pontou as before,
and the start of the st in the air. The acroplane was mounted on a single scow-shaped pontou as before, but Mr. Curtis has added three wheels such as he uses on his ordinary biplane intended for flights over land alone. He believes that much of the flying will now be done over water, and that many of the discussed cause will have to be put in order again to provide safe highways over which avarators can fly and upon which they can alight in case of emergency.

avaitors can fly and upon which they can viriate an alight in case of emergency.

The Winning of the Michalin Trophy for a 222-mile Cross-country Flight.—On March 7th Eugenc Renaux, a new French March 7th Eugenc Renaux, a new French a flight with a passenger from Paris to the watter, won the 80,000 Michalin Pruse for a flight with a passenger from Paris to the watter, wor the Puy de Dome mountain, some 323 miles away. The trip was made in boars and 8 minutes elapsed time. A deduction of 17 minutes for a stop at Nevers makes the actual time in flight 8 boars and 31 minutes, which corresponds to an averge pyped of 84% miles an bour. The flight was made with a Parman hiphane, and in accordance with the rules the avaitating of 48% miles an bour. The flight was made uncertained the failsh. The landing, upon the summit of the 4,902-foot-high approximation of the 4,902-foot-high approximation



Union Increases

When two groups of tele-phone subscribers are joined together the usefulness of each telephone is increased.

Take the simplest case—two groups, each with three subscribers. As separate groups there are possible only six combinations—only six lines of communication. Unite these same two groups, and instead of only six, there will be fifteen lines of communication.

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Day Letter Telegrams.—Night letter telegrams have proved so successful that a day service has just been inaugurated, the letter to be sent at reduced rates at some time during the day convenient to the sending company.

ing company.

Ripening Bananas by Electrical Heat.

—Experiments have proven that bananas may be ripened to the best advantage by subjecting them to a dry heat of seventy-five degrees in an air-tight room. Recently electrical apparatus has been employed for producing the necessary best is a ripening producing the necessary best is a ripening or the necessary best in a ripening of the necessary best producing the necessary producing

means of thermostats. Utilisation of Water Power in Switz-erland.—The Swiss Industrial Water Union estimates that 60 per cent of the total water power of the country is used for generating electricity. This is a much larger proportion than in any other country in the world. The water power of Switzerland is rated at L800,000 horse-power, and this year 70,000 horse-power, and this electric power stations.

Ico Cream Piant as an Adjunct to a Power Station.—Recently electric power stations have found it profitable to manu-facture ice during the slack season in order to equalize their power production the year round. Another step in this direction has round. Another step in this direction has just been made by an electric light station in Nashville, Illinois. A refrigerating plant has been installed capable of producing 80 tons of ice per day, and in addition to this an ice cream plant has been established capable of manufacturing 40 gallons of ice cream per day.

cream per day.

Wireless Automobile Outfit for the
German Army.—The German army has
recently decided to adopt an automobile
wireless outfit of a very good design. It
will be used with each division of cavarity
and carries six men and a set of vireless
apparatus. A telescope must be considered
which commission is to be a set of the considered
which commission is to be a set of the considered
fore connecting a wire to the automobile
outfit. Six minutes after the car stops
the apparatus is ready to sero signals. It

in a few minutes and anchored steady before connecting a wire to the automobile outfit. Six minutes after the car stops the apparatus is ready to send signals. It has an effective radius of 100 miles. Fighting Corrosion with Electricity.—It is largely because of electro-chemical action that boilers become corroseds, and to overcome this, it has recently been suggested and the control of combating the destructive action of chemicals in boiler water may be conducted very economically. Measuring Gas by Electricity.—A novel Measuring Gas by Electricity.—A novel

Measuring Gas by Electricity.—A novel gas meter has recently been invented, in which the flow of gas through the meter is determined by the quantity of heat necessary to raise its temperature by a definite amount between two fixed points where thermometers are placed. The gas current is amount between two fixed points where thermometers are placed. The gas current is heated by an electric coil, and the thermometers for measuring the heat at opposite sides of the coil consist of fine resistance wires forming the arms of a Wheatane bridge. The advantage of this scheme is that the recording mechanism may be placed at any desired position, for instance, in the general office of the gas company, even though it may be a mile or more from the gas works. The meter consumes one kilowatt-hour for a flow of 75,000 cubic feet of

The Development of Electric Railroad Lines in Italy.—Electric railroad work is very active in Italy at the present time. Some of the lines will use current from hyvery active in trade at the present time. Some of the control plants Tradic will good commerce on the Mont Cenis Railroad line, and the Chimothe bydraulic plant is to farnish the current. Another electric reliroad is the Giovi line in the region of Genoa, and it is also to be opened shortly. One of the highest electric railroads in Europe to use adhesion is the new Bernina line. It passes over the Bernina Pass at 7,700 feet altitude in order to connect the Albula and Valleties of the Control of t

Guns Win Agedust Armes. The Mary Department considers that the negatic ob-tained in the recent "Kaishidal" target ex-periments are very encouraging. Of ten 19-inch shells fired at a range of 200 yards, with an initial velocity of 2,400 fact a second, four hits were re-8 and 10-inch curved plabes were com penetrated. The more madern guas calibers length, therefore, soom to is latest battleship cruisers, with their 10-inch armor, completely at their when within range. dr 8 to

when within range.

Imported Australian Railway Ties.—

A cossular report states that 10,000 railway ties of what is known as Tamansian oak, a species of Rucalyptus, have been salpped to the United States, and other alipments are to follow. Forest reads laid with this timber over fifty years ago are found to be still sound. In gravel ballast and under a rainfall of 90 to lockes, these ties will last fifteen years; indeed, after twenty years of use, they have been found to be in good condition. Se hard is the wood that, even on curves, the plates are not necessary.

Value of Compounding and Superheat

necessary.

Value of Compounding and Superheat
in Locomotives.—The Lancashire & Yorkshire Railway. England, has made a valuable addition to our knowledge of the value
of superheating and compounding in locomotives. In a series of tests of compound
versus simple locomotives, on the bests of
time and total coal and oil per train tommotive the series of tests of compound
versus simple locomotives, on the bests of
time and total coal and oil per train tommotive the series of the series of the series of
the series of the series of the series
extended to the series of the series
test of non-superheater and superheater
freight locomotives on a similar basis, there
was a maximum increased percentage value
for the superheater of \$4.1 per cent.

Past Buroposa Express Trains.—Es-

for the superheater of \$4.1 per cent.

Past Encropean Express Trains.—Espress speeds in Greet Britain and on the
Continent are high. In Great Britain there
are eleven daily express trains making runs
of from 30 to 1189, miles without a stop,
whose average speed is from \$1 to \$6.5 miles per hour. The fastest and longest
non-stop run is \$23.5 miles, from Paddington to Plymouth, made at \$6.8 miles per
hour. France has seven daily expresses
that run from 17%, to 147% miles without
stop at speeds of from \$1.1 to \$1.5 miles
per hour, and there are nine French trains
that run from 103 to 147%, miles without
stop at speeds of from \$0.4 to \$9.5 miles
an hour.

Strength of Weed After Long Service.—

Strength of Weed After Long Service.—

atop at specer an hour.

Strength of Weed After Long Service.

Evidence that structural timber, if properly protected, does not deteriorate in ordinary service is afforded by some white pine beams, which formed the chords for a timber bridge during eighteen years of service, the bridge being covered during fourteen of these years. Tests of the timber showed an average clastic limit of \$5.00 pounds, and a modulus of repture of \$5.00 pounds and an modulus of repture of \$5.00 pounds and service which According to the property of \$5.00 pounds and \$5.00 pounds and \$5.00 pounds and \$5.00 pounds and service \$5.00 pounds and service \$5.00 pounds and \$5 pounds per square inch. According to W. K. Hatt, of Purdue University, who records these facts in Engineering News, white pine beams of large size are credited with an average modulus of rupture of 5,000 pound

per square inch.

Pansama Canal Tailia.—It is proposed in Congress that the tolls through the Pensama Vary from 20 cents to 81.20 a net ton. In order to stimulate the construction of American shipping for service through the canal, the lower rate may be accorded to vessels of the United States and of Pansama. To neutraliste the competition of the railreads, there is a provision preserving that any construing trade vessel owned ing that any construing trade vessel owned whose stock is controlled, etc., by any railread company, etc., shall pay the highest rates as authorised by the bill.

Bituminous Materiel Cheeds Road Description of the controlled of t per square inch.

Bituminous Material Checks Ro Bituminous Matarial Checks Road Destruction.—Trainmy to the great road-preservative value of a hituminous binder is found in the report of the Sitate Highway Commission presented to the New York Legislature, who ask for 680,000,000 in addition to the 890,000,000 already suthersized, to complete the Sitate and consuly system of improved highways. A top so binding course of hitumineus enabreds, says withstand the destructive action of motor which time, but to chimains the dust unique and raight impaction and participated and raight impaction and participated the possible to exactuate the spublic results at a present of raight impaction and participation.



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Science
Wherein Coal Bessibles Isa.—Coal, petroleum and illuminating gat are related to one another much as are few, water and steam. For this reason, perfect combustion of liquid fuel is already advanced a long step toward vaporisation, just as fee is advanced toward steam when turned into water. The volatile elements of coal are locked up in the solid form, or virtually frozen solid. Dewar demonstrated how from the so-called personant tests to make them liquid, and how much more to make them solid. Yet Nature has soliditing gas into the form of coal, and solid coal, like solid lev, will disalove into vapor only through the expenditure of heat.

Pressuration of Collidad Scientinas.

Preparation of Colloidal Solutions.— Colloidal solutions of metals have been ob-tained by numerous processes, most of which are based on the reduction of metalisland by numerous processes, most of which are based on the reduction of metallic saits by various reagents in special conditions. The production of each solutions possesses practical as well as scientific interactions of the production of several conditions. The production of several ployed in medicine. Swedberg has indicated a new method of preparing colloidal solutions by the disintegrating effect of ultraviolet rays on metals. The metal, the surface of which should be entirely free from code, is covered with a thin layer of liquid and exposed to the rays of a Hereus lamp placed an inch or two above the liquid. In case, the conditions of the condition of the condition of the conditions of the condition of the conditions of the condition of the conditions of the condition of the con

Helium and the Age of Rocks.—Recent theories of the evolution of radium have been ingeniously employed for the compu-tation of the age of rocks. Strutt has given a very simple formula, according to which 9.13 × 10-8 cubic centimeters of belium are produced annually per gramme of uranium peroxide (U.O.). This result makes it pospercodde (U,O.). This result makes it pos-sible to reduce from the chemical analysis of g numeral the number of years which have clapsed since its crystallastion. This method, however, is open to numerous ob-jections, and its value appears to be en-tirely destroyed by cridence recently con-tributed to Radison by Pattly, who shows that fused minerals may absorb hellum gos. Part or all of the hellum found in mineral; that fused minerals may absorb helium gas. Part or all of the helium found in minerals, therefore, may have been imprisoned be-fore their solidification. This result ex-plains the presence of helium in atthing and other non-radiocative minerals. As, on the other hand, a temperature of 150 deg. F. to which rocks must often have been sub-jected since their solidification, is sufficient jected since their solidification, is sumecent for the extraction of the greater part of their belium in eaceso, the quantity of helium found in them bears no defaulte re-lation to their age, and can only be used to determine roughly the average age of a well characterised group of minerals.

to determine roughly the average age of a well characterized group of minerals.

Boots and Coffee.—In Germany, in the eighteenth century, two afterward comments of the control of the con

REAL FARMERS HAVE STARTED TO COLONIZE FLORIDA FARMING AS A BUSINESS

By W. B. RUSSELL

If you were going to open up a business, you would want the best location possible. If you buy a farm you not only want the best location possible, but you want good soil, good neighbors, good climate and good transportation facilities.

Not all people who are buying farms in the wonderful State of Florida are judges of farm land. As a general proposition all Florida land is good—se is better than others. If you were selecting a diamond and you didn't know value of precious jewels, you would probably call on some friend or acquaint-whom you considered to be expert in this line.

Just so in choosing a farm you want the best advice obtainable. Thirty-seven German farmers will give advice that can be depended upon. Remember they are practical farmers and come from the greatest agricultural race in the world, the Germans.

would, no eveniment and the first the scene of the most tremendous agricultural wards that the scene of the most tremendous agricultural planes who want to Florida some few years ago and have most considered been the means of arounds pintense interest in the State's future. It great agricultural wealth is now becoming known to the people of the earth, and nothing can stop her in her triumphant progress towards agricultural suprements.

can stop her in her triumphant progress to tare people to tale PATO, And Botting can stop her in the triumphant progress towards agricultural supremature and the stop of the property of the

These are the principal factors, then, that guided these farmers in their selection of this particular tract of Florida land, soil climate—good transportation—the three great and necessary essentials to an agricultural success.

Some Figures from the Census Reports on Levy County

Some Figures from the Census Keports on Levy County
In 1906 the casus shows that Levy County produced a crop of 1,120 inshels of potatoes from 17 acres, which the growers sold for \$1.700 or a trifle over \$100 an acre. It gored to 17 acres, which the growers reviewed an average of \$6 cents a crast, or a total of \$81.710 acres for manner yielded
1756 crasts for which the growers reviewed an average of \$6 cents a crast, or a total of
when the county was fret telling settled, when the average was annual and the extress had not
yet gone in for the kig money crop being still unacqualited with the soil and the assaun, and
ill laboring under the difficulties which very settle must face the first year. The
You years later, however, the cross report above 45 method increase in the yields of
crast, or \$7.005, or a total money yield of \$500 an acre. The same year 110 acres of excensberg produced \$4.500 crasts, which soid for \$43.000, or 10 cents a crab, making a total money

[10] the Cheber are not musual cross. They are not the reverse house from the stress included

[11] the contract of the same produced the contract of the same produced \$4.500 crasts a crab, making a total money

[12] the contract of the contract of the same produced the

yield of \$200 an acro.

These are not unusual crops. There are not the reports on a few sample acres, picked on to make an extra good showing to wait. They are comin figures arithered by government.

They have acressed to not tage, but those are not all the cope that the farms of Lery County grow in those years. Math farmer grow but a few acres of each repetable and many grow less than an area of each or while many gree most of these particular products.

The figures quoted here are the average yield of all the servage in the county planted to these veptables. If you are an average main and can get an average crop off an average farm, you should get what these injuries show if I you are better than the average, you should get more, but bear in mind that the average money yield no tomatoes in Levy County in 1967 was 85000 an average yield on countries was \$2500 an are.

These figures are given just by way of showing that it pays to farm in Florida, and to show where the big money in Florida farming is to be made

Levy Countr also grew in 1907, according to the Census report, \$58,851 worth of corn, \$18,144 worth of cats, with hay and live stock in proportion. We give you the figures of 1907 because the course report of 1910 is not yet available. Doubtless, they will show a much larger increase in acreage to the yield per acre.

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ce in the interactive sear you.

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of \$200 per acre and upon terms that will astophs you—only \$100 down a
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emation coupon below will give you a photographic history of this great project. This book is "A lone and a Rundeness in Florida for \$2500".

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is known as particularly fitted for this great work.

Mr. John M Flewellen has had 18 years' experience in the growing of vegetables
Florida, for the winter market of the North. He is thoroughly acquainted with Florida so
shipping methods, e.c., and known how to get the best results in the quickest time with
displaced to the property of the propert

The soil of the Lonon Forded Bram & deviewe in character, running from the famous gray sandy loans to the deepest and releast of black hammock. Those soils have level tried adapted to every overtable netw to black hammock when the found adapted to every overtable netw to the branch of the soils have level tried adapted to every overtable netw to the branch of the property of the soil of

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Artista' Mistakes

ATERIA Michalica

No a noted picture exhibited not too long
Lago the artist, well known for his ability to "hold up the mirror to nature,"
nevertheless made a curious error, which
he would not have committed had be taken
the trouble to acquaint himself with certain
habits of the beast he portrayed in that
picture.

A tiger is above abilities the set.

period to the portrayed in that picture. A tiger is shown alading its thirst at a stream. The artist does not show much more than the head of the beast, and it is life size; but he made the blunder of burying the mouth of the creature far below the surface of the water, making it drink as one may see a horse any day drinking at a trough, and not isppring up the liquid like a cat, as of course a tiger would. It is curious to understand how an artist who could paint well enough to command for his picture a place on the walls of an important eahl-bitton, could make such a fundamental mistake.

bitton, could make succ a runnimental mistake.

Another, chample, shown at the same Another, champled a done with outcassed, and the same and the sa

not the exception.

not the exception.

Some years ago a leading scientist pointed out that painters were liable to fall into errors of another kind through ignorinto errors of another kind through ignorance of the elementary laws of optical
phenomena, and he gave them many
valuable lessons and warrings. It was
shown that, although geometry had been
applied to perspective and anatomy to
form, artists as a class seemed to have
come to the conclusion that the phenomena
associated with air, say, and see meed
there was the case of a capable painter
who pictured a rainhow inside out! When
the work was returned to the artist for
correction, he was so much disgusted
with what he regarded as a preposterous
demand that he charged one hundred doilears for replacing the colors of the bow

with what he regarded as a prepositerous demand that he charged on hundred doi-lars for replacing the colors of the bow in their proper relative positions. Another painter had the temerity to place a crescent moon in the eastern say directly opposite to a setting sam. When the fault of the color of the

A distinguished astronomer once took A distinguished astronomer once took the trouble to measure in several paintmgs the size of the moon, and to deduce from it the height of the mountains shown in the same picture. He found that the average height of the hills was about forty-three miles, while one giant peak armsed its head more than one hundred miles above sea kevel!

nules show see kevil
It would, of course, be absurd to tie an
artist's hand, and to say that every touch
of his brush must be made with scheitlife
securacy. The langinative faculties must
have play, or we should have no pictures
worthy of the name. Threes, who was one
of the greatest masters of landscape composition and coloring, frequently exaggerates the heights of his shills with the
intention of conferring upon them a majesty which otherwise they would not
possess.

mation, it is not surprising that errors of a far grosser kind were committed by the painters of past centuries, whose learning was necessarily timited by their environment.

learning was necessarily limited by their environment.

The most comming ervans were brought about by confusion of pariod, by which the affairs of centuries spart were down-tailed and blended in the most curious fightion. In the early works of the German, Flemish, and Dutch arlists are found both anachronisess and incongruities in plenty. That the Garden of Eden should be painted by a Dutch artist as having well-lipped borders and yew trees cut in quaint devices is excusable, for the draughtanan was unsequinated with any other type of garden. In 1744, we are told, there was a picture to be seen in a Dutch village in which Abraham appeared ready to scraffee this son lasare for the control of the second of the control of the Licentities.

Pictures are shown of the Israelites crossing the Red Sea, armed with mus-kets of comparatively medern date. It is in the matter of costume that the

It is in the matter of costume that the early painters found such a stumbing block, and there is no difficulty in seeing how this arose. They painted the scen-ery and dreases of such widely different countries as Palestine and Egypt without having any knowledge of those places or any opportunity of acquiring reliable in-formation. In the National Gallery at Ediluburgh there is a picture in which formation. In the National Gallery at Edinburgh there is a picture in which Pharoah's daughter and her ladies are attreed in the long-watated bodies and hoped skirls peculiar to the sixteenth century European woman. In another picture of the same date, representing Joseph and his kindred in Egypt, which is hung in the National Gallery in Lon-dous of the Same Ladies of Same Ladi

the buildings; they are all Italian in type. It was impossible for even such a genilus as da Vinci to know that a table, a spotless table cloth, plates, knives and forks, to say nething of salt ceilars, were wrongly infroduced into one of his most famous works, and that the Eastern people whom he painted used neither tables of the control of the con

In more recent times we find that ans-chronisms of costume and scenery were chronisms of costume and scenery were as common little more than a century ago in dramatic representation as they were in the pictures. In a portrast of Mrs. Hartley in the character of Cleopatra, she is dressed in a hopped petiticout, over which is a pannier skirt and a long tram, the skirt being adorned with fostoons of roses. Her waist is confined in the stifficial of corests, while she wears on her bead an earl's coronet, surmountied by an outrie hulture. It would read by an outrie hulture. It would reon ner need an earr's coronet, surmount-ed by an ostrich plume. It would re-quire the pencil of one of the world's famous caricaturists adequately to express Anthony's surprise when he saw his Cleo-patra arrayed in such fantastic style.

Anthony's surprise when he saw his Cleopatra arrayed in such fantacit style.

And it would not be the first time that a picture had been caricatured by reason of some incongruous feature. For instance, there is a well-known picture of Napoleon crossing the Alps. This subject has been quite a favorite theme with artists; but the particular example referred to show the Emperor in gorgeous castoms, mounted upon a richly caparatic light at the august burden which it is bonored by carrying. Such is the remarked to the mind of the imaginative painter. The caricaturist has given us a far more prosale representation of Napoleon's famous journey. It is snowing hard, and the Emperor, so closely wrapped in his clock as to look like a mere bundle of rags, is crouched upon the back of a wretched much. A fall characut, as lean as the poor music, graspe dogs it with the lack of a wretched much con hand sign depression of the probably far more historically correct that the more serious work.

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worthy of the name. Turner, who was one promise to the greater ansatzs of landscape compression and coloring, frequently exage. There is now under construction at Barrow, greates the beights of his shills with the intention of conferring upon them a major which is the proposed convertence, and the contraction of the devict of the devict of the devict of the proposed. The proposed cruster of the devict of the de

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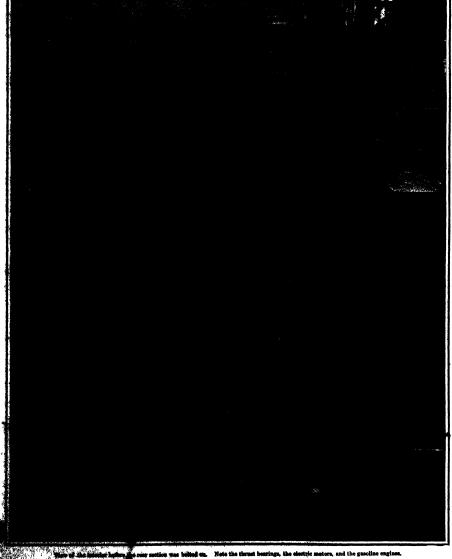


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SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, MARCH 25, 1911

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles dont, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at require space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable as readily understood, as to set forth and emphasize the inherent charm and fascination of science.

The Gould-Scientific American \$15,000 Prize

TilaT the munificent offer by Mr. Edwin Gould of a prize of \$15,000 for the heat aeroplane equipped with multiple engines and propellers, has awakened widespread interest is proved by the number of designs which have been submitted to this office. We take this opportunity of stating publicly that inasmuch as a representative of the SCIENTIFIC AMERICAN will be one of the of the Scientific American will be one of the judges of the centes, it is impossible for us to offer any opinion upon the merits of such designs. Furthermore, it should be clearly understood that mere paper plans, however much excellence they may possess, will not be considered in the present contest; which must be between practical flying machine, carrying an operator and flying over a prescribed course under strictly regulated conditions. Plans are required merely to assist the judges in arriving at a decision.

In solite of the great advance which has been made.

arriving at a decision.

In spite of the great advance which has been made
in the speed and duration of flight since the date
when Mr. Gould's offer was first made public
through our columns, the necessity for an improvement in the motive power of the aeroplane, particularly as regards its durability, is as great to-day as it was last year; in fact, the energy of acroplane builders is being directed to an improvement of the notive power more than to any other part of the ma-hine. The offer of the Gould prize, therefore, is timely, and its object of promoting safety and durability is distinctly in line with the present trend of seroplane development. Multiple engines and twin propellers have been among the most important factors in rendering travel by ocean steamship safer than travel on land. Properly designed and adjusted, they should prove equally efficient in promoting con-tinuity of flight, and in bringing the acroplane to a safe and perfectly controlled landing.

A Satisfactory Compromise

SECRETARY OF WAR DICKINSON is to be congratulated on the position which he has taken on the subject of lengthening the piers At taken on the subject of lengthening the piers at this city to accommodate large occan steamships. In permitting a temporary increase of length, he meets the pressing necessities of the White Star Company, whose 882½-foot "Olympic" will reach this port during the coming animer, and at the same time, by granting the coxtension for a limited period only, he sustains the army engineers in their jealous guardianship of public rights in our national waterways. The White Star Company are permitted to extend their piers for a distance of one hundred feet into the North River by building a structure of temporary open timber work, which is to be removed after the explaintation of eighthen months. This will reuporary open cumoer work, which is to be removed after the expiration of eighteen months. This will permit the "Olympic" to dock on the North River, and at the same time it will give this and other stramship companies that are building ships over steamship companies that are olimining simple over 800 feet in length, sufficient time to provide suitable accommodations for berthing the new vessels. The moral of the recent dilcums is that the whole subject of dock accommodation and the provision

of suitable terminal buildings and railways, should be taken up at once and a comprehensive plan laid

down, which will take account, not merely of the pressing needs of to-day, but also of the increase in size of the individual ships of the future, and particularly of those engaged in the passenger-carrying trade. The investigation of this question should cover every foot of water front that can possibly the utilized for wharf and tempinal purposes. The whole scheme should be laid ant on a casefully co-ordinated plan, so drawn up that the various sections may be constructed from time to time, to meet the growing traffic of the future. The study made by Dock Commissioner Calvin Tomkins, of that part of the problem, which covers the North River water front on Manhattan Island, is admirable, and may well serve as a basis upon which to draw up the larger plan, covering the whole of the foreshore of Greater New York.

The Spirit of Science

N these days the practical and material gains which are brought to the community and to the individual by the advances of science are so obviously and so constantly presented to our minds, that to the casual observer the promise of such material rewards might perhaps appear to be the leading motive for man's endeavor to fathom the mysteries of nature.

Yet, if we study the history of science, this is hardly the impression which we receive. Not only have most of the great pioneers followed their light in a large measure regardless of any consideration of personal gains of a material kind, but quite on or personal gains of a material such state quarter the contrary, we need only turn to the records of medieval history, to find the martyr of science, driv-en by the spirit within him to seek the truth at all costs, and to proclaim it though his reward be tor-ture and death at the hands of the inquisitor.

No; the prime, the fundamental motive which has impelled men to decipher the hidden meanings of nature has not been the prospect of material gain, clse had they not been willing to suffer and die for the truth, but the sublime pleasure, the exalted ec-stasy that comes with revelation of truth to the mas-

The glorious transport of the hero- "das Helden-glück" as Ostwald calls it—few perhaps are priv-ileged to experience. Yet the impulse to fathom the problems of our existence is so primitive, so funda-mental a trait of the human mind, that probably mental a trait of the human mind, that probably none of us are quite free from it. In some of its phases the instinct of inquiry is most plainly evi-denced in childhood, and is, alsa! too often choked almost out of existence by the cares and petty an-noyances of every-day life as we grow up. Enough, however, is left to most of us adults of the "child wonder" to enable us to complete by introspection our analysis of the elemental enotions through which the mustif of extence holds meen in facinities.

First, then, and most primitive is our innate capacity for being stirred to wonder and are by the contemplation of the grandeur of nature. Who has not experienced a feeling of mental exaltation when gasing up into the unfathomable dopths of the gasing up into the unfathomable depths of the "starry cluster" on some gioriously illumined sum-mer night? At such moments there is an attempt on the part of the imagination to fill in the gaps where the discernment of our senses fails, and to span the untold distances over which our limited powers are incompetent to carry us. This exercise of the imagination is for some reason felt as a pleasurable experience.

anie experience.

But the feeling of wonder is only a first and very
rude step in the journey which the individual and
society have traveled to reach the vantage ground
of modern scientific attainment. If there is a cerof modern scientific attainment. If there is a cer-tain pleasure associated with a mere feeling of unsatisfied wonder, a new seat is added to the situation if through one circumstance or another, as corner of the veil is lifted, and a gleam of under-standing lights up our mental sight to a compre-tension of the phenomenon that at first merely a well us. In one form this is pre-eminently the pheasure of the younger student of science, whose personal-knowledge can as yet be readily extended by the comparatively easy means of imparting to him the

howledge can as yet be readily extended by the comparatively easy means of imparting to him the knowledge gained by others.

As the student matures, he may pass more or less imperceptibly into the next stage of development, and taste of the pleasure while comes of the discovery of new truths by, his own effort. The titue when he passes into this phase can not be greenled the discovery of new truths by, his own effort. The titue when he passes into this phase can not be greenled the discovery of the discovery of new truths by, his own effort. The titue when he passes into this phase can not be greenled the discovery of the disco

carliest efforts met portage transity send there is reclisioner independently whit offices here force them. But as their green for years and importage, they sooner or later give to us those genes in the crown of science, whose leased easie its representational removes and immortal fame to the piencer gentles. Such a man tasks not only of the joy of having historic gained knowledge by his own efforts, but he knows also the deeper astifaction which aprings from the consciousness of services rendered and benefits becomed trans the world of the property of the constitution of services rendered and benefits becomed transit to make the property of the constitution of services rendered and benefits becomed transit to make the property of the prope erliest efforts me**j**

consciousness of services rendored and benefits be-twowd upon the world at large.

There is still another phase in existife progress, whether we think of the individual or of the com-munity, which brings its own pleasure: The sense of mastery over nature that follows upon successful application of scientific knowledge to the further-ance of human welfare. A James 'West teaches us to wield a new weapon in our aggressive warfare for the conquest of the world by man. A Pasteru gives into our hand the means of defense to ward off the last remaining enemies of machind—foce which have into our hand the means of defense to ward off the last remaining enemies of mashind—fooe which have baffed us so long, not through their strength or over-powering dimensions, but through their very clusive minuteness. Who shall say which is our greater debt, the one we owe to Janse Watt, or that due to Pasteur, and which the greater joy—that of the engineer adding to our means of gaining wealth, or of the devoted physician and pioneer of medical science, ministering to the health of national? Many are the fascinations of science, even to him who is content to look on white others tail and wer-

Many are the fascinations of sectence, even to him who is content to look on while others toil and wor-ship at her shrine. Greater, and indeed overwhelm-ing, must be her hold on him who, with the hair of the expert, and the mind of the genius, explores new regions, and brings lack from his excursions to his fellowmen at home the trophies of new truths wrested from nature a cypher record.

New Feats in Aviation

THE progress being made in aviation this year appears to be as rapid as during 1910. Curtiss has perfected his aeroplane so that he can start and alight on land or water at will, thus leavstart and alight on land or water at will, thus learing nothing further to be accomplished in the fundamentals of dynamic flight. Wireless messages
have been transmitted from an acroplane in flight
and received by land stations 40 miles away, while
learly this month McCurdy's biplane, at a height of
1.500 feet above Palm Beach, Florida, was able
to eath messages from Key West, and even from
a steamship leaving Panama, that is, over distances
as great as 1,000 miles, and this despite the fact
that the wireless operator was provided merely with
a makeshift hadpiece of tawels to bind the receivers to his cars and protect him from the noise
of the unmuffled motor. Thus, if ever a transatantic of the unnuffled motor. Thus, if ever a transatlantic acroplane becomes a reality, its aviator may be in touch with both New York and Paris during his trip across. As for long-distance communication by wireless, messages are now being regularly sent from Glace Bay, Nova Scotia, to the Eiffel tower at Paris,

Glace Bay, Nova Scotta, to the Eiffel tower at raris, and the Hertaian waves have been transmitted and received successfully in the opposite direction.

As for performances at flying, several spectacular and astonishing digiths have been made during the month. The first of these was on March Srd, when Lieut. B. D. Foolois and Philip Particle. srd, ween List. B. D. Fonios and rhinp ramalec flew from Laredo, Texas, to Eagle Pass—a distance of 116 miles—without a stop, at the rate of 48.8 miles an hour. They carried rations for several days and made the flight for seouting purposes like those of actual warfare. During the cnseveral days and made the flight for scouting purposes like those of actual warfare. During the entire trip they were in wireless communication with various land stations. Two days later Lieutenant Bagne, of the Feurth Algerian Rifles, in an attempt of years are Mediterranean via Corrico and Sardins, lost hig vary but finally alighted safely on Gorggone, a small wooded late between Corolea and Leggioten. He covered 136 miles straight-line distance—above the san while dying for several hours, in his Hissiste mouseplane. The central distance traversed was much greater, for the aviator lost his way and early managed to make Gorgons just before, like fuel foccasio exchanated, for the saviety lost his way and sulp managed to make Gorgons just before, like fuel foccasio exchanated, for the saviety lost of the limit of \$90.000 for a light with a passenger from late to the Puy de Done Mountain—as asi-line bance, of \$90.000 for a light with a passenger from late to the Puy de Done Mountain—as asi-line bance, of \$90.000 for a light with a passenger from late to the Puy de Done Mountain—as asi-line bance, of \$90.000 for a light with a passenger from late to the Puy de Done Mountain—as asi-line bance, of \$90.000 for a light with a passenger from late to the Puy de Done Mountain—as asi-line bance, of \$90.000 for a light with a passenger from the passenger from late to the Puy de Done Mountain—as asi-line bance, of \$90.000 for a light with a passenger from late to the Puy de Done, he cathedral, as the late of the cathedral as the late of the cathedral as the late of the cathedral as the late of \$100.000 for a light with a passenger from the passenger from late of the cathedral as the late of the cathedral as the late of the cathedral as the late of the late of the cathedral as the late of the late of the cathedral as the late of the late of the cathedral as the late of the late of the late of the late of the cathedral as the late of the late

The Submersible "Kobben" for the Norwegian Navy By the English Correspondent of the Scientific American

The "Kobben" running at 12 knots on the surface.

THE Norwegian navy has recently been strengthend by the acquisition of a new submersible "Koben." This vessel is of the "Germania" type, evolved
and developed by Fried, Krupp A. G., the eminent German arrament manufacturer and naval builder,
which has now become the standard class of submartine in the imperial German navy. In fact, the
"Kobben" may be considered the latest development in
the Krupp submersible, and is not only powerful, but
goessesse many interesting features. The recent trials
of the craft have aroused keen interest among European naval circles, owing to her striking seagoing
qualities and seneral technical perfection. The Krupp
firm have always considered the "diving" boat to be
the most efficient form of submarine, and it may be
mentioned that their contentions as to its all round
superiority are upheld by the German government
awal authorities, for there were twelve author-rables
fitted for service on the high seas in the Imperial
mays at the end of 1910, which on account of their
speed and endurance are suited to all the conditions
of modern war.

The "Kobben" was built at the Germania yards of Kiel, and measures 129 feet in length, with a beam of 13 feet 2½ inches, and a draught of 12 feet 5 inches. The displacement on the surface is 225% tons, and

The vessel is provided with two hulls. The outer has the lines of a torpedo boat, which with the high free-board and superstructure serve to render the boat extremely seaworthy. inner hull is divided into inner hull is divided into three longitudinal sections, being built up of three circular welded sections boited together. This shell sufficient strength to enable the craft to withstand safely a water pressure equivalent to a depth of feet. The space between the outer and inner hulls is subdivided into a number of watertight com partments, which contribute greatly to the safety of the vessel, since a number of these may be punctured without endangering floatthese may ability. The water hallset oil, and gasoline tanks are also carried in this space.

The engine room, containing the propelling and auxiliary generity relation of the accumulator battery. Surpliced art, together with a portion of the accumulator battery. Surpliced propulsion is effected by two sets of four-cylind engine meters, developing an aggregate of 440 horse-power, while when traveling submarged two electric meters developing an aggregate of 180 horse-power are invested into service. The chapter of the secondary developing an aggregate of the secondary for the secondary for the secondary of the secondary for the fourth of the secondary of the secondary and the secondary of the secondary of the secondary of the secondary of the secondary in the secondary is the secondary of the secondary in the secondary is the secondary of the secondary of the secondary is the secondary of the secondary in the secondary is the secondary of the secondary in the secondary is the secondary of the secondary o

boat. The conning tower, built up of light plating, has a ship-shaped form, for the purpose of minimizing near statements of the purpose of the second section of the electrical accumulators and the torped outbe room and gear. There are two torpedo tubes carried in the bow, while on the deck aft, mounted on a bridge is a third tube

the deck, aff, mounted on a bridge, is a third tube on the dring rudders are mounted in pairs, one on their side, fore and aft, with an ordinary vertical rudder at the stors for lateral storting. Each motor set drives a reversible propeller. The accommodation for the navigating officers is in the conning tower, while the quarters of the crew of ten men are in the bow, as is also the galley.

In the Lake types of the Germania class of submersi

In the Lake types of the Germania class of submersi bles, Direal engines, using heavy oil in preference to the more volatile and inflammable gasoline, are used These motors develop from 200 to 220 horse-power For underwater navigation the usual electric motors are utilized. The heavier oil engines are useful in those seas where the lighter fuel is unobtainable. The Kobben, however, is adapted to gasoline, which is more easily secured in Norway. The surface speed of the boat is twelve knots per hour, and she can make nine knots per hour submerged. The radius of action the surface at the reduced speed of nine knots is

 $1.450\,$ mfles, while submerged it is 45 mfles at the speed of 6.5 knots per hour

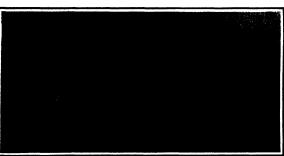
Special arrangements have been made to secure an adequate ventilation of the interior of the boat. During surface operations the air is drawn in from outside. When traveling submerged, the heated atmosphere of the engine, and the exhaled air of the crew, is drawn off through ventilators which pass it through various filtering, oxygenating and cooling devices, after which it is returned to the interior. By this means it is possible for the craft to remain under water for twenty-four hours at a time without the crew experiencing any inconvenience or difficulty in breathing The electric accumulator compartments are hermetically sealed so as to prevent escape of polsonous gases into the interior, and to prevent the spilling of the contents through the rolling and pitching of the boat when diving. Two periscopes are carried, the tubes of which are each 161/2 feet in length, which permits the craft to be navigated at a depth where it is secure from the fire of projectiles. Various safety appliances are fitted to prevent the vessel being placed hors de combat either by hostile fire or accident. The water ballast tanks can be emptied of water and charged with compressed air very rapidly, there being a reservoir of 123½ cubic feet capacity con-stantly maintained under

cubic feet capacity constantly maintained under high pressure for this purpose. In order to facilitate the salving of the vessel, the outer hult is furnished with a number of shackies, to which the hawsers of the salvaging appliances can be attached for raising the craft to the

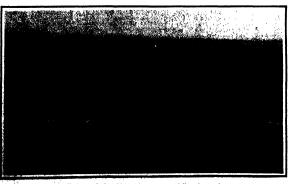
A telephone wire is also carried whereby communication with the interior of the submarine from the surface can be maintained. The outer end of this line is attached to a buoy which can be released automatically.

After the "Kobben" had completed the builder's trials it was dispatched to Horten, the Norwegian maxal base, under its own power in the course of this journey it was deeded to curry our deep water to the source of the source of the feet, where we waste was made for the work of 164 feet, where mained for two hours, Sub-sequent examination showed that the 'water pressure had produced no permanent deformation of the hull.

Among the man't tests to which the "Kobben" has since been subjected were a series of trials in the open sea, during a strong southerly gate. Several surface runs were made to prove the seagoing qualities of the boat Afterward a number of trips were made at varying depths up to 48 feet to ascertain the effect of wave action upon the boat These tests, it has been stated, were eminently successful.



The submersible boat "Kobben" running on the surface.



The bost swash, with couning tower partially submerged.

A NEW SUBMERSIERE FOR THE NORWEGIAN NAVY

Life-Savers for Aviators

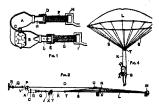
Two New Parachutes Invented in France

WHATEVER perfection may be reserved for the VV future, at the present stage in the development of the new art of flying the aviator takes his life in his hands every time he rises aloft in his aeroplane. Efforts to secure greater safety may take two different directions We may strive to prevent a catastrophe or, despairing of entirely eliminating all accide we may look for means which shall afford protection to the aviator in an emergency It would seem, most logical, and indeed in keeping with accepted practice in other pursuits involving life risks, to pa tention to both these aspects of the problem. Among life saving appliances recently brought out for avi-ators use there are two which seem to deserve special ators use there are two which seem to deserve specials notice, namely, the Esnault Pelterts safety belt and parachute, and the apparatus recently put to the test by Hervieu at the Elffel Tower in Paris. The Esnault Pelteric safety belt not only protects the aviator from shock, but also prevents him from being thrown out shock, but also prevents him from being thrown out of the machine. In addition, this belt may be con-nected by elastic bands to a parachute, so that in case of accident the aviator, by pulling a rip cord, can open the parachute and float suspended from it by means of the beit, which is not tight enough to in-teriere with his movements. The apparatus is itlustrated in the accompanying diagrams, of which Fig. 1 shows the belt attached directly to the frame of the aeroplane without a parachute Fig. 2 shows the combination of the parachute with the belt. Fig. agives a view of the entire apparatus at the moment after the rip cord has been pulled, and Fig. 4 shows the aviator auspended from the parachute The belt is composed of two curved portions A B

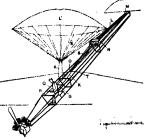
which can be connected by a pin at C and are attached to the straps a b passing through the buckles DE India rubber bands FG connect these buckles to eyes HI on the frame of the aeroplane. In order to put on H to the riams of the acropians. In order to put on the belt it is only necessary to draw out the pin C, separate the parts A and B, pass them around the waist and connect them again by inserting the pin When the belt is designed to be combined with the

When the belt is designed to be combined with the parachate it forms a chosed gridle about the aviator's hody, as shown in Fig. 2, and is connected by India unbber bands FO to two buckles J attached by the cords K to the parachute L The apex of the parachute is held by a spring clump M, and its folds are entired by a glued band of cloth N. The edge of the parachute carries a steel wire. which folds in such a manner that the mouth remains slightly open. The top of the band N is attached to a cord O connected with the link P, the other end of which is at

tached to an India rubber band or a spring Q, which is fastened to the chassis at R. The cords S of the rachute are attached at T to the cords K.



ult-Pett and parachute.



cord O passes over one or more pulleys U. The apparatus is operated as follows: When the avis When the aviator of the rubber band O. detaches the buckle P from its

hook V. Then he lets go the word, a bend Q, in virtue of its classifity, sense the cord Q, which cuts or team off the mouth of the parachute is then open enters, expends the parachute in the the hook M. The parachute them as stime L (Fig. 3) and the joyding A may upward and backward treeting. Misseshy upward and backward tractors suggestly dea in detached from the hook I in which it held by a lightly gived strip of sloth I will by the pull on the cord of. The artistar himself lifted from his seak and waspends belt from the parachus, as in above in the The second device of which we have an

parachute of somewhat peculiar

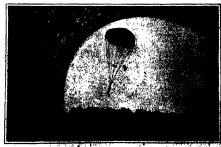
One of our illustrations shows very clearly the mushroom shaped distended envelope of the parachute as it appeared at the test recently made in Paris. In as it appeared at the test recently made in Parts. In the background is seen the pillar of the Biffel Tower, from the first story of which the device was faunched. Billi acother view shows the parachets at a later stage in its descent to the ground. The passenger on this trial trip—who, be it easid, eame cut of the ordeal unscathed—was the dummy shown asseted on ordeal unseathed—was the dummy shown seeded on the tueslage in Fig. 7 do us illustration. The inventor, M. Herviou, is seen standing in the foreground of this picture. The arrangement of the presentate on the fuselage of the aeroniane, when folded up and not in operation. Is indicated in Fig. 8. It will be seen that the apparatus collapses into a flat parcel contained in a kind of box or case, neatly stowed away over the rear end of the fuselage.

A later test of a 28%-foot parachute with a full-sized Biériot monoplane body and a dummy weighing 165 pounds, was very successful. After less-than a second's drop, the parachute opened, and, while the body of the monoplane fell to the ground and was body of the monoplane fell to the ground and was bupben, the dummy landed without about, and at a speed of not over? Twice an hour. A tilled superi-ment was made, the attenderment that in the superior of the first and the superior of the superior of the with bell bearings and weighted with 138 pennis. It is M. Hervick intention to develop as automatic parachute for dirigibles as well as for acrop idea being that as soon as the dirigible be nees being that as soon as the dirigible becomes de-flated, several parachutes will open and save the car and passengers. The weight of the parachutes used in the above experiments was only about 15 pounds. The parachute has been the subject of much con-



Fig. 5. - The trial trip of the Herviet parachute at the Eiffel Tower.





g from the first story of the Billel Tower.



NEW SAPETY BELTS AND PARACEUTES SOR ATLES

The Automobile as an Advertiser

A New Way of Attracting Attention

By Arthur Buxton

UTOMOBILES for use in advertising are being amployed by certain business establishments to serve a double purpose: To advertise the product of the company, and to make deliveries to their cus-

The vacuum bottle on wheels, shown in one of the scompanying flustrations, carries out very effectively the lines of a torpedo-type car, with its long wheelbase (151 inches), narrow neck in front, porthole side openings, and general suggestion of a "long, low, rakish-looking craft." The big bottle-body is of cast aluminium, finished inside in mahogany and red morocco leather, and the car has a six-cylinder, 120horse-power engine, and cost, complete, about \$15,000. The whole effect is that of an exact reproduction of the well-known heat-insulating beverage bottle of the

travelers' convenience, perambulating the streets, and the slogan of the company, "Keeps hot, Kee, is cold," is inscribed on the wheels. This car is at the pres ent time on tour throughout the United States.

ent time on tour throughout the United States.

Another bottle car, often seen in the downtown husiness district of New York city, serves to advertise a brand of writing ink. The car is a small runabout, and is used by the New York satesane of the ink



The curve of a huge plume leads grace and piquancy to the back and canopy of a feather company's car.



This car follows fast vehicles to demonstrate that the autor' speed is largely based on prejudice.

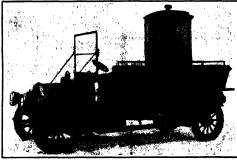


A bottle car used in advertising a brand of ink.

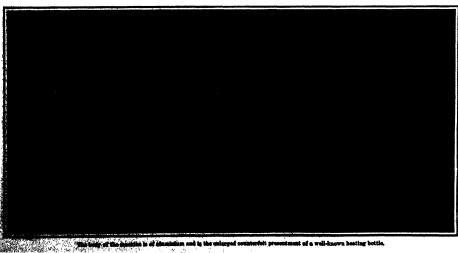
The big bottle serves as a storage receptacle.



A car that carries its company's goods in rear compartment.



A geyser of puffed rice is made to burst into the glass dome of this advertising car.



company in visiting its trade; and the ink-bottle, carried at the rear properly right-side up, makes a capacious van for the use of the car as a delivery wagon "Bottled goods" of another kind are advertised by the Moxie car, with its box compartment at the rear. A horse-drawn wagon is also used by this firm, having a body in the form of a big bottle of this beverage, carried in the vertical position. The driver halts at the curb-side, climbs into the bottle through a door at the back, and dispenses the beverage by the glass to thirsty passers-by.

Another example of successful representation of the article advertised in the lines of an automobile is the neal little car employed by a New York dealer in ostrich feathers. The smooth curve of a giant ostrich plume, worked into the body of the car, arches grace-

fully over the back and forms a canopy over the seat.

The remaining two views show the advertising autos of an "auto-meter" or speedometer manufacturer and
of the company manufacturing a well-known readycooked breakfast food. The effect of a demonstration
of the product is added to the effect of an animated In the first car, the gigantic instrument at the back is a working autometer, registering and in-

strument on the dashboard of the car, and connected strument on the dashboard of the car, and counsered to its running gear. This satio has been run those, sands of miles through city and suburban streets and over country roads in all parts of the country, 50 demonstrate that the speeds at which anton are ordinarily run are in reality eafs, notwithstanding popular projudics. The driver of the auto-modern popular produce. The autority car, or a team of fast horses drawing a carriage, and runs behind this other wish-cle at the same speed with it, allowing its occupants and the passers-by on the road and sidewalk to observe—generally with surprise—that the customacy pace of these vehicles is fifteen or twenty miles per hour, as shown in plain figures on the big instrument. This car has attracted attention wherever it has appeared, and has received a great deal of newspaper no-tice; and it is stated that the demonstration of safe driving speeds on the road, afforded by the car, has done more to affect public opinion in the direction of safe and sane legislation on the speed-limit for automobiles than any other influence

The other demonstration auto is a large touring car with a delivery-wagon body of ample capacity. Placed

stidway of the besty is a hashistical dome, harring at the bottom is gentled in a small shired operated by the sentine needs of a friction which controlled the through the internal passed in given to bright me high the dome while the farrer at internal passes is agree; or set to burst up into the done. This performance only flagstrates the slopes of the demposity, abor thus gene, to onlockers to the storping, abor thus gene, to onlockers to the storping of the entry of the care of the entry which they are passing.

In another car operated by a steam-leomotive manufacturer who also makes automobiles, the advertising feature consists of a little locometive stand-ing on a section of track and having a tender and a ing on a section of track and having a tender and a fast car attached, the whole mousted on the humes. This miniature train is equipped with tipy slectric lights, and its wheels are made to agin around by a small electric meter; and the fast car carries is respo-duction, on a small scale, of a racing one which was wen by an auto of the company's make.

The Triumph of Intellect Over Instinct

The Modern Trend and Where It Leads

By Alfred J. Lotka

In the popular mind instinct is a faculty essentially characteristic of the lower animals, and reason, in its full development, the prerogative of man. So much has this point of view been emphasized, that perhaps there is a tendency at times to overlook the very important part still played by instinct in human affairs. The infant in the cradle, with its mental faculties still dormant, is of necessity dependent on instinctive actions. A little later the growing child enters into that precious inheritance. It is not to the property of the control in the property of the control in the co

driven us.

A similar influence is seen at work in the domain of the other fundamental instincts of which mention has been made above: our sense of desailines, prepaidly, and moral rectition, those safeguards of the physical, mental, and moral welfare of the community.

By Alfred J. Lotks

These three instincts, or perhaps rather groups of instincts, stand in an obvious and close relation to one another. It might be said that there is a certain gradation from the first to the third. Purthermore, each of these instincts is known to us in two modes of manifestation. In the spectator any offense against the laws of cleanliness, decease, or morality calls out feelings of more or less disput, indignation, or condemnation. This might be termed the "active" mode of manifestation of the parameters of the common of exposure, experiences emissive mode of manifestation. This might be termed the "active" mode of manifestation. This might be termed the "active" mode of manifestation. This might be termed the "active" mode of manifestation. There is a desire on the part of the offender to withdraw from the public grace, to seek seclusion. The spectator, on the other hand, turns sway in disgust, perhaps free from the scene, or in more extreme cases, especially of moral of-frees, may seek to limited pushbanent upon the offender, nearly the seek to limited pushbanent upon the offender, institucts is to temporarily or more or less lastingly institute to offender, or even to extryate him from the community. We might describe them as "quarantining" institutes the offender, or even to extrapt him from the community. We might describe them as "quarantining" institutes a seek to the common of the seek to the seek

man race. Once the intellect has clearly grasped the true source of dataper, the billed instinct becomes not only unscassary, but may be a proved to the provide of cleaniness of the my better of the provided of cleaniness of surface of cleaniness to flag, but quite the sweets. The weeks of cleaniness to flag, but quite the sweets. The weeks of the cleaniness to flag, but quite the sweets of the cleaniness to flag, but quite the sweets of the cleaniness of the methods of treating that these set of the constitution of the cleaniness of the methods of treating that these of the constitution of the cleaniness of the methods of treating that these set of the constitution of the cleaniness of the methods of treating that these of the constitution of the cleaniness of the methods of the state of the constitution of the cleaniness of the cleaniness with which the student of biology dissects some ungalmly creating, of the pathologist handles some repolative production of the pathologist handles some repolative process of the cleaning that the cleaning of the cleaning of the cleaning that the cleaning access of their structure and proper disposal of adisons of their structure and proper disposal of adisons wester matter, suggest that the cleaning that the cleaning the cleaning the

Correspondence

The distinguish various Pro-decadaoughts
To the Stillier of the Sourcerrot American
The like Styles of a friend in the Bursan of Construction; and Repair, I send you the following—the
hope heigh on bring the matter before the largest
number of respies, in order that the error herein set
turbs riser, be sourceated. I have been told that this
error than the structure of the dreadaought
you down the stillier mounting a less number of gates, owing to the shorter heattle column, was
not instruction that is correct. It is evident from
an imposition of the disprain i send you that the argument, is the language of Prof. Tyndail, "does not subtend a visual angle." In a late issue of the Sourgrow American you mention the usefulness of the THE ASSESSMENT YOU mention the usefulness of the pre-dreadnoughts in forming a reserve division, which could be pushed forward after the engagement of the more powerful dreadnoughts with the enemy. Why not advocate more vigorous taction? Place the "antinot acrosses more vigorous account. The battle is joined, and let them reduce the

dreadmodern modern dread-noughts and super-dreadnoughts of ٥f the enemy to a condition compelling them to seek their home docks for repair, and then bring forward your own dread-nought feet to the sec.

WALTER PROCE JENNEY, PR.D. Washington, D. C.

The Lew of the

To the Editor of the SCHENTIFIC AMERICAN:

The popular acceptance of the acroplane as a means of locomotion, and the firm belief of some of our legislators in vast increases in the number o f these vehicles in the near future, is already leading to the enactment of statutes relating to their registration and regulation Bills pertaining to aeroplance have been prepared both California, that in the latter State even specifying the lights to be car-ried. (See Aero-nautice, March, 1911.1

The aeroplane will doubtless be

will desiblines on capable of speeds far exceeding the read speed of the automobile; shall be it for this reason, as well as the impossibility of marking the illimitable serial high-ways, Miss boundaries will be definite only so far as ways, fittes boundaries will be definite only so far as they are segaraphically evident. State regulation of the hempiese spells a far genter; numance, and leads to "with eners theorymenton, than does the State con-trol of the automobile, the transfer of which to fed-erate and the state of the second of the second of testing at the present time. Again, the State has also the justification of the second of the second of the justification of the second upon a damaging little season the reads.

that it has for gainsubtles, based upon a damaginf influence cones has reade.

An in horse sections lowe for our sorial floots, as the profession section code in all adjacent for the profession of corpolance in a company of the profession of corpolance in a company of the profession of the profession of the company of the profession of the profession of the company of the profession of t

be free to pass across State boundaries, unhampered

y local checks or regulations.

If the foregoing be accomplished in these early days of aviation, the troublesome lesson of automobile registration will have served a useful purpose—the precluding of difficulties in one phase of interstate commerce, the extent of which is only a matter of confecture W. R. M. VERY

Ithaca, N. Y.

The Thaddeus Stevens Industrial School

We have received from Mr. William Mellor a letter which we publish below. We have much pleasure in giving publicity to this communication in our umns. Helping others to help themselves is the best form of philanthropy. Even from the purely com-mercial standpoint of public economy, such measures represent a most paying investment, making good citisens of persons who would otherwise, often through no fault of their own, be in danger of becoming a charge and a dead load upon the community.

We may add to the statements made by Mr. Mellor in his letter, that, according to a circular issued by the Industrial School, admission of new scholars is

40 Pro-Droadnaugh? Baltischile -80 ours - (4 - 18" ours east) part de la company de la compa 20 Shipe - 15000Men -80-12"6 Oppored to 5 Bips - 5500 Mon - 50-12 Cuns

at 9,000 yards between five super-dree Diagram of an engage oughts carrying fifty 12-inch guns and oughts with eighty 12-inch guns

40 m

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made in April, an examination for admission being held about four months previous to this period. subjects are reading, writing, arithmetic, geography, United States history, and composition. For further particulars address the school. Mr. Mellor write

To the Editor of the SCIENTIFIC AMERICAN:

We are subscribers to your valuable journal, and I have thought that you might find it convenient through the medium of its columns to bring our school to the notice of poor boys in the State of Pennsyl

The Thaddens Stevens Industrial School is located in the city of Lancaster in Lancaster County. It is now engaged in teaching the following trades: Bricklaying, carpentering, patternmaking, and the machine trade. Boys to be admitted must be 16 to 18 years of

trade. Boys to be seminted must be 16 to 18 years or ase, having a common school education, of good moral character, and residing in this State. Pope orphan boys have the preference in the choice of admission. The course will require three years, during which time they are given clothing, board,

lodging, one of the trades above mentioned, together

with a good high school education.

Knowing of the large circulation that your publication has among drawing rooms and shops, master mechanics, and workmen, I hope that it may reach those who know of some deserving boys who would be glad to avail themselves of just such advantages.

Hoping that this will meet with your favor and otics, I remain, Respectfully yours,

notics, I remain, Respectfully yours,
William Mellos, Superintendent.
The Thaddeus Stevens Industrial School. Lancaster, Pa.

Why Not Use the Moon to Drive a Machine?

To the Editor of the Scientific American

The writer of this letter lays claim to advancing no new idea, but believes he is possibly presenting old ideas in a new light. The object being to divert a portion of a large amount of gray matter which is running to waste into a channel where it may eventually

help turn the wheels of progress. Reference is made to the immense amount of mental effort expended on perpetual motion machines. My understanding of such a machine is one which gets its

impetus from some natural force which

is forever active.
It is well known that a great many of these machines are founded on the assumption that it possible for ball in descending from one plane to another to develop more than enough energy to wriggle and twist a similar ball from the lower plane to the upper; the more compli-cated efforts appearing like attempts to sneak the ball up without the attraction of gravity catch ing them at it As gravity has never as yet been caught napping, up to the present time there have been no sucmachines recorded.

But gravity is not the only force which is forever active. The attraction of the moon for everything on this earth is just as unremitting, with the great disadvantage that it is not so appreciable, and with the great advantage different directions at different times. An immense pendlate in accordance with the position of the moon, but it

housed on account of wind currents, and I never found in my astronomy a formula for computing how many miles high the building would have to be in order for the movement to be visible to the naked eye. But given such a building and such a pendu-lum, a machine, deriving its impetus from this pendulum and storing enough energy to keep it going during the time the pendulum would be comparatively at rest, would be as truly a perpetual motion machine as if it derived its energy from gravity

Nature has furnished us with several great pendu-lums in the oceans. A machine attached to these as, which shall store enough energy to keep going while the tides are at rest, cannot possibly be disqualified as a perpetual motion machine merely be-cause asture furnished us the pendulums. The men who are attempting to harness the tides are really ex-perimenting with perpetual motion machines. Those Inventors who are experimenting with perpetual mo-tion would do well to devote their energies to mak-ing practical use of something which we have. Amsterdam, N. Y.

The Largest Hydraulic Turbines in Existence

The White River Hydraulic Electric Development

By Barrett Smith

T WENTY-FIVE miles southeast of Seattle and ten I miles east of Tacoma there is a ridge which rises very abrupity to a height of about 400 feet. Beyond this ridge and stretching away castward to the White liver there is a high and slightly shelving plateau. Lake Tapps, a large natural basin, is located on this plateau less than two miles from the western base and some 440 feet above it.

The present development takes advantage of this remarkable situation by diverting the waters of the White River at a point eleven miles distant, conducting them northwesterly across the pigtons and storing them in Lake Tappa, from which, dy means of a tunnel through the western ridge and posstocks on the wastern slope, they will be discharged down to the power house in the valley. An immense volume of water will be stored. The water above the outlet gates, that is to say, the water that could be drawn oft to generate power, would cover a square mile to a depth of 100 feet. This great reserve will give the White River plant the unique distinction among large developments of the country of being able to operate at a capacity of \$5,000 horse-power for an entire month independent of inflow, and allowing for seepare and evaporation.

age and evaporation.

In addition to Lake Tapps, with its ultimate area of 3,000 acres, there will be five basins impounding water at points along its course from the White River to Lake Tapps. The White River drops away to the northwest from the point of intake, and a series of flat benches some two miles long is formed along the brow of the plateau. Embankments all along the north or alley side of these benches will transform them into a chain of four basins, the points of land which separate them being cut by canals. The westerumost of these basins is being connected with Lake Tapps by

a five-mile sanal which, at a point sear its center, passes through an open valley between embankminnts over one-quarter mile long and 650 feet epart, affording the fifth auxiliary storage basin.

Just before entering this basin there is a fall of 30 feet in a distance of one and one-half mines, making possible an auxiliary development here of \$,500 horse-power at comparatively small expense should it be desired in the future.

To complete the ends of the waterway of which simply the central portion has been described, there is a timber fitme and wood-lined casal 1.1 miles long at the upper end connecting the intake with the chain of basins, while at the lower on there is a 2,000-foot canal and a 3,000-foot tunnel connecting Lake Tappe with the pipe lines on the slope above the power house. The pipe lines are 3,300 feet long and lie on a slepe of one foot in five.

While preliminary work on the development was done in April and May, actual accountion was not begin till well into June. Nevertheless, on January ize 730,000 yards of earth and been removed. This was not been work of five steam shovels and represents an average output of a train of standard railroad cars over a mile long each day for six days every week since the excavation was begun. These figures are difficult to comprehend, but they mean a total of some \$8,000 carloads, or a solid train 170 miles in length. The \$30,00 yards is more than half the total excavation, which will be about 1,300,000 yards, and shows in general what procress has been made.

Among the other things already done that do not, show in the statement of earth removed or embankments made, are the following: The main dam and pilling for wing wall; about 25,000 yards of concreting at the headwork; some 3,000 feet of twive-toot tunnel; and over two militon heard test of thinks and and eaged by the constructor's savanil as Jain Talles for damp treates, hune, tannel tempers are saved Jaine. This savanil cone \$6,000 feet of thinks 2 and great the logs. It will be required in, one a total of Milition for, which would build a five-loot sidelysis, askending from Seattle to New York.

There was also extensive preliminary work, which is point of time consumed was charged assistation; the job at the outset, but which species the job all figs. way through, so it should be dedicted geen the lifes in should not an electric property of the lifes in should not be the life in the lifes in should not be the life in the life in should not be life in the life in should not be made and distributed over the whole particular allows against connecting with the Northern Pacific Railway at the power house and at the headworks. It should have a large spallway at the power house as permanent incline railway one-half mile long squipped with a large electric hoist that halts up the standard gase Pright cars and their beart-act loads with ease. The hoist receives enread over at 2,000 voit line from a construction sensitation, near the power house site, which contains 3,000 kilowati transformers. The transmission line continues on to Lake Tappe where it supplies the assumil, and now is coming into additional use for the construction of the power house itself, a motor driven dombie centrifugal pump being installed at Lake Tappe with a 12-inch pipe line 7,000 feet leng over the ridge for hydraulically excavating the foundations and for supplying water to the gravel washer.

The main equipment of the power house has been ordered, it will consist of two 13,000 horse-power single runner, will obtain the state of two 13,000 horse-power single runner, but the sach coupled to a 19,000 K. V. A. 4,300-voit gapessur. There will be two banks of transformers stopping the current up to 60,000 volts for transmission.

Christening the "Suchard"

The Airship Which is to Essay a Transatlantic Crossing in the Trade Winds

By Carl Dienstbach

O'N February 15th, Joseph Brucker's airship winds expedition, was solemnly christened by Princess Henry of Prussia. The ceremony was almost identical with the familiar scene at the launching of a steamer. But while the "flotation" of a see-going was expect at that stage, and its mechanical equipment guite rudimentary, exactly the reverse was the case with the airship. It was complete, but not quite ready to rise, being only partially inflated.

All details were open to inspection. The weights of the several parts are as follows: Envelope, 2860 pounds: ballouette, 770 pounds: pallouette, 770 pounds: piging, 440 pounds; belt to which the suspension "crowsfeet" are attached, 176 nounds; rudder and stabilisting planes, 440 pounds. The maneuvering gas valve has a diameter of 334, inches; the two safety valves each of 234, inches. The car (motorboat) is suspended by fourteen wire cables, each fastened to a system of seven "crowsfeet," the typical Parseval suspension. A quantity of 3,740 pounds of gasoline is carried in seven tanks in the bottom of the boat, and about 650 pounds of oil is taken along in cans.

The propellers are of wood and measure 2.8 feet in diameter. They are mounted in a bearing frame built of seamless steel tubing. The two 100 horse-power motors are placed in the rear in line with the keek, the gwe flywheel facing cach other. They will be used only alternately during the trip, thus affording a strong guarantee of reliability. They run at 1,000-1,200 revolutions a minute, imparting to the propellers, through chain garning, as speed of 800-850 revolutions a minute. The one engine can be coupled to the motorboat's water propeller. An enormous radiator is placed above the transmission, between the motors. The blower for the air ballonette, driven by transmission from either of the main engines of the transmission from either of the main engines of ya hand, sucks its air through the redistor, thus providing especially efficient centiles.

efficient cooling.

The runway for reaching the envelope and the valves is suspended directly to the former by special tackle, in the Parseval style. Beneath it the running weight is carried on a cable. There is a ripping

panel that may prove hard to tear open after a trip of a week's duration has hardened the glue, such panel being properly a device designed for the sphemeral "sphericals."

There is an interesting plant for electric lighting, including searchileths, current being supplied by a storage battery that weighs 308 pounds, but of which 110 pounds is arranged to be dropped as ballast after exhaustion. These batteries, as well as the meteorological, nautical, and seronautical instruments, are lent to the expedition free of charge. The water spraying device is operated from the capitality "oridge," it can be easily and instantaneously worked by hand, spreading the water in a very thin film over the creviope.

film over the cuvelope.

The "scoops" for taking in water as ballast are made of sheet steel, such about 28 inches long. Owing to their fashlike shape they slip through the water with but little resistance. After filling through one of the four holes the shell automatically turns around to allow the water to enter through the next hole, until the entire scoop is full. A special Mind of windians operates these shoops, which can be dropped through a distance of 500 feet.

in some experiments recently carried out in the Kiel harbor, in which an equilibrator of the Wellman type was dragged behind a torpedo boat, the resistance of the apparatus was found to be quite excessive.

The problem of launching the motorboat on the ocean has been, worked out quite carefully. Ten of the suspension ropes are cast loose in the air; this four remaining ones are all slipped at the same instant by a special apparatus the moment the best touches the water.

On the occasion of the christianing coresneyr the interior of the big sirable house at Kiel was all debrarded with flags and pine branches. Music-was provided by the naval band of the Emperors yields "Rôbensoliera." Among the grosses assertibles with Admiral Lans, the members of controlled with Mayor of the city of Kiel, other members of "She musicipal council, the local government authorities, and a great number of askal uddoes. Presently Prince and Princess Henry of Pruseffs arrived, lead atter acchanging the besid greeting, sensitied the

richly decorated christening platform ereoried in front of the boat bow, just as is the custom for launching ships. Mayor Lindemann, of Kiel, who is inkeep prises dents of the Noteley for Motor dents of the Stelety for Motor Aeronautics, delivered the christening speech. He recalled the earliest expeditions to America by wester, first by the Novemen about A. D. 1909, and later by the Novemen about A. D. 1909, and later by recalled the earliest expeditions to America by wester, first by the Novemen about A. D. 1909, and later by the Novemen about A. D. 1909, and later by the Novemen about A. D. 1909, and later by the Novemen about A. D. 1909, and later by western about the progress of water navigation, he passed on to appeal to the present project, dwelling on the fact that the idea which Mr. Brucker had proclaimed with unvarient seal and unfilteding courage, and at much personal secrifice, had been taken so personally hyperbolic the best aeronautical and melescrological, singerts of his country, and had been matured by them with so much of the proverbial Germann thoroughness, that 4t could not fall to finally convince sven the mest skeptical.

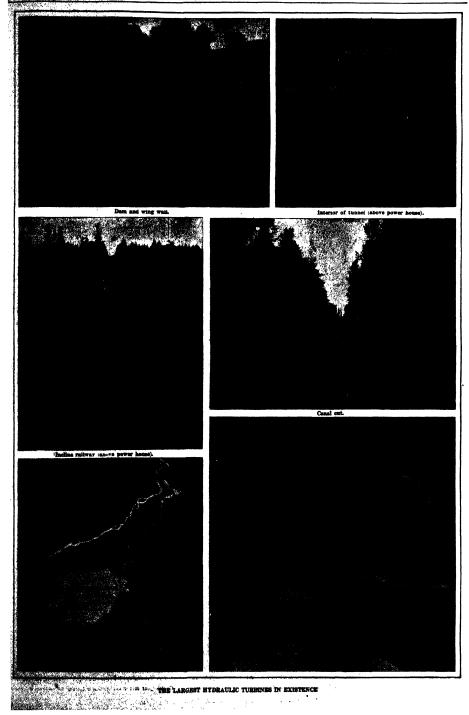
He then preised the members of the expedition for the courses in their consistions which that sites played, being prepared at great personal risk to peres the correctness of the underlying theories and the scientific and practical importance of their play. He wished the enterprise success "for the honer of German science, German thoroughness and German skill." Then Princess Henry broke a bottle of champages against the "Suchard" bow with the words, "I christes thee with the name of "Smehard," and what these a properous voyage."

which the a prosperous voyage."

The determony closed with some remarks by Dr. Gans Tabrics, president of the expedition, three closers for the Kaiser, and the playing of the national hymn by the Imperial Band.

Special Food Investigations

CONDITIONS revealed in the owners of the subplets mant of the food and drugs set often makes it alriable to understace special completed in or the process of manufacture and authorization heartillar of substace produced and authorization heartillar of substace produced and produce, and deal and constant and produce, and food ones. The constant is a produced of the process of the set of the purpose of developing where or improved processes have also been understants.



New York's Automobile Fire Service

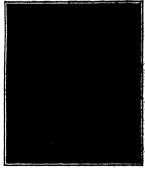
Another Step Toward the Retirement of the Horse

By Herbert T. Wade

WHEN a procession of motor-driven fire appa-VV ratus rolled out of the doors of the repair shops of the New York Fire Department recently, it was quite evident that automobile equipment for fire pro tection was firmly established and had passed any experimental stage. On this occasion were shown the new motor-driven steam fire engine, the remarkable water tower recently described in these col-umns, two large size automobile acce tenders for the tunns, two large size automotics case tenders for the high pressure service, a small size automobile hose tender, and two supply wagons which can be used at large fires to transport coal from the fuel depote to the engines at work. All of these ware in active operation, and not only did they exhibit greater speed and power than horse-drawn apparatus, but records and tests of apparatus already in the had demonstrated their economy of maintenance and operation, the saving being in most cases sufficient to pay the cost of new apparatus within a period of four or five years at the most.

With much of this apparatus the readers of the SCIENTIFIC AMERICAN are now familiar, with the exception of the new gasoline propelled steam fire engine which is attracting the widest attention. Its recent trial was watched by representatives of many cities, one engineer being sent to New York from Los Angeles

it must be recalled that the fire engine is es tial in New York in districts where there is no high pressure service sufficient to send a stream of water from a hose nozzle to the top of the highest buildings. As it will be many years before such a system ings. As it will be many years before such a system of independent mains and hydrauts will be installed in large cities, it is still necessary to develop fire engines on the score of economy and efficiency. The first step in this motor age is to remove the horses, which must be fad, shod, and otherwise maintained whether the apparatus agavers nine or nine handred. alarms a eyear. Furthermore, the drawing power of the horses is limited, and a three-horse beam sin handle only a certain weight with the possibility of a fall on snow or toy pavement. Many years ago

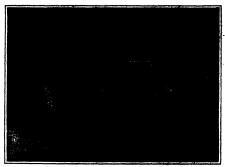


Fire Commissioner Waldo at the steering wheel of it

steam propelled fire engines were used and abandoned. Those present at the recent trials received one or two auch machines used by the New York. Fire Department which used by clather since the bble stones, pouring sut, 50

Ca touring ear, but this type the suburbs, until very real point where the especi pumps could be considered compared with the steam fi present fre engine wis a known present system of water sumply s wife of heing condity transporte and, so that it would give efficie

omy, then, could l and power sad commonly then, count as secured deligy mechanical propulsion, and cartefup prec-sed not be interfered with by any change in the r or, pumping machinery. This was what was in the engine for the New York Fire Depart-shown in our illustration with Commissioner ment shown in our literaration with Commissioner Widds at the steering-wheel. A new second-size engage had recently been delivered to the department. In buildens, who had been experimenting for sewral pass on this problem, made the proposal to take the steams engine back to their Minneapolis shops, lengthen the Spense. In front and install a gasolite engine with class, drive to the rear wheels. Nothing size was to be done; bother and pumping engine were restanded in their entigrical condition, and the only innovation was the arrangement of the motor and the front wheels—all well shown in one of our photographs. Under the beaust is we be fessed, a four-cylinder four-cylinder the principle of description of the condition of the c

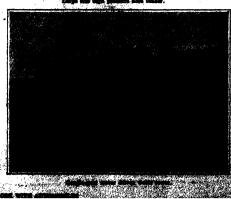


Automobile hose tender.





nation-propolled steam fire engine at river limit.



PICHTOIG PIRE DI NOW YOU

Head Noises and How One Scientist Studies Them

Dr. Marage's Wonderful Machine

By Jacques Boyer

\$30 careful discusses of line sar, the patient hears sounds littles here he objective extensee. Dr. Marage recently communicative the better the Academy of Sciences the foliatoring results of his study of these subjective sounds. The academ sorp to divided into three classes Noises, excellent sortes and, words or road cries. Among the communication of the subject is a history or better things sound of very high pitch, buyond the limit of the mutual scale, which has patient compares to the history of gas excepting which the patient compares to the history of gas excepting the communication of the subject of the patient of the subject of the subject of the patient of the subject of the subject of the patient compares to the history of gas excepting the subject of the subject of

through a small orthon the whist-ling of the wind under a door, or the sound heard her acound heard rhen the car is spilled to a tele-raph pole. Then ouse, ta order of iserecasing f re-assney, the beat-ag of the pulse, he chirping of rickets or cleadas, leaves, the crack-ing noises of the telephone, the measured tread of a troop of soldiers, and various strange noises, which pa-tions have likened to the meeting of railway trains un-der a roof on which heavy rain reliway trains under a roof on which heavy rain was falling, the runbiling of a recoding cart, the choffing of a pack of cards, and the rolling of thunder.

The musical sounds are less varied. The patients seem to hear sleigh bells, alectric bells, drawn, trumpets, drawns, trumpets,

drums, trumpets, evens pipes, church hells (usually fancy themselves in an aviary filled with birds of all kinds, while others hear for months tunes which they know

ennot repeat.
Words and vocal sounds constitute the third class of subjective sounds. The patient bears the crosk of a freg (the versel sounds and o), the cuckoo's note (oo), spoken words which are always the same but which cannot be recalled, the shouts of an interiored mob.

Application of high-frequency currents for the cure of abnormal hearing of the pulse-best.

Dr. Marage calead 1,000 coses

chould 5,000 coses

de chould 5 deaf

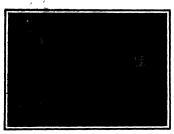
de visit in the cose of the case of the cose of the cos

which the vibrations of the car drum are communicated to the lance car. This view is confirmed by experiment, for the whisting sound is beard by a normal person in whom the stirrup has been displaced by artificially diminishing the pressure in the middle ear. This explains the infrequency of the whistling sound in deafness caused in the contract of the confirmed the contract of the whistling sound in the contract of the whistling sound could be produced only by the

Dr. Marage's vowel-producing siren.



Vibratory massage for the cure of subjective sounds.



Treatment of subjective hissing sounds by means of low, sonorous vibrations,

DR. MARAGE'S WORK

stirrup being facel in an abnormal position by the healing of the wound, and this seldom occurs. The treatment or cases is which whisting is the only subjective sound heard is suggested by the facts recounted above. In order to suppress the whisting it is merely necessary to bring the attrup gradually back to its normal position. This result can be accomplished by means of sonorous wheretone of small intensity which displace the attrup by less than one into sound of short pitch, produced by forcing air at how pearance through his well-known area, which has already been such a strong the superposition of the sound of the pulse, associated with different contrasts of the such contrasts of the supplementation of stemants are required. By a few spiglications of sitemating electric currents of very high, histography (d'Aponous currents) to the ear, Dr. Marege, hise relieved spread patients of the circulation that is not problem to the set of the manying sound. The currents produce this result by acting upon the vasonacter nerves

which control the circulation. For the treatment of the other abnormal sounds (which are not affected by the high frequency currents) Dr Marage employs vibratory massage of the head at the level of the parietal and temporal bone. This treatment is successful when the trouble is of recent origin. Dr Marage explains this retund to the following theory: The abnormal sounds (except those due to displacement of the sirrup or to anomalor troubles) are caused by a pro-active excitation meaning the sirrup and the sirrup or to the sirrup or the sirrup or to the sirrup or the sirrup

example, the sound of a bell is heard continually because the ele-ments of the nerve ments of the acree fibers and centers, like the filings in a Branly coheer, maintain the conducting position which they assumed when the sound of a real bell was last heard Dr. Marage & now engaged in ultra-microscopic researches scopic researches designed to test this theory He hopes to prove that solid particles of nerve tissue assume definite po-sitions under the influence of sonorous vibrations, at least in the case of the lower ani-mals. The verifi-cation of Dr. Marcation of Dr. Mar-age's theory, how-ever, is not re-quired to establish the value of the simple methods of treatment devised by this eminent agrist.

The Current Supplement

IN the current SUPPLEMENT, No. 1838, we find a number of re-markable articles on technical sub-jects, of most di-verse interest. verse interest.
Thus, Mr. Frenk
C. Perkins contributes an article
on an English
water dynamometer for absorbing
1,000-brake horsepower. - Passenger transportation ger transportation has developed the most complex problem that is to-day presented to the engineer for solution. Its difficulties are very ably set forth in an article by Mr.

J. Vipond Davies, under the title, under the title,

an article by Mr. J Vipond Davies, and the control of a Rapid Transil Railroad in Relation to the Handling of Passengers, as Historiated by the Hudson and Monhatta Railroad. "Cement side-walk paving is admirably described by Mr. Albert Mayer, of the Cement Users' Association—Mr. Herbert L. Towles, in an article entitled "A Few Slop) Jobs on an Old Car, 'etcle how the ware due to use is made good, the control of the Cement Users' Association—Mr. Herbert L. Towles, in an article entitled "A Few Slop) Jobs on an Old Car, 'etcle how the wave due to the samely good on an Old Car, 'etcle how the wave due to the samely good on an Old Car, 'etcle how the wave due to be used to be the class of repairs, necessitated by such things as sagging of the frame or aske, or beach in the steering connections, may be remedied—Mondern scientific research in discussed by Sir William A. Tilden—Hy on a particular morning at a particular pot on the land surface of the globe, the chances are about two in the that you could satisfy your excitoity by visiting a meteorological Birary and consulting Ra files of daily weather maps. In on entertaining article entitled "The World's Daily Weather May," the whole sabject is popularly reference—William T. Scrill declared in the value of illuminating engineering to the considered and.

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

News from Venus

THE question whether other planets than the earth are inhabited has long interested autronomers and laymen. We know that the earth is only a comparatively small member of the solar system, and that the universe contains millions of suns which are probably surrounded by planets. Hence it appears very improbable that our little word is the only inhabited planet in the universe As we know nothing of the planets rowing about other suns, let us confine our attention to our own solar system. If a planet has a solid crust which has exceled to a moderate temperature, and an atmosphere similar to our own in chemical constitution, if water is found on its surface, and if its superior, in the surface, and if its superior is found on its surface, and if its superior.

ficial or atmospheric temperature does not for any long period rise above 100 deg F. or fall below —30 deg. F., it possesses all conditions required for the maintenance of highly developed life, such as exists on earth. We know, indeed, that living organisms possess a very great power of adaptation to varying conditions, but it will be affect to confine ourselves to the limits given above

Mars and Venus are the only planets in the solar system while satisfy these conditions. The general appearance and configuration of Mars are very similar to those of the earth, and some astronomers are inclined to believe that Mars is inhabited

How is it with Venus? asks a writer in Reclums Universum nearest neighbor of ours, which, however, is 25,000,000 miles near er the sun than we are, and which performs its revolution around the sun in 224% days, he tells us, is not so accessible to observation as the exterior planets. "The angular dis-Venus from the sun is never very great. We see the planet now as a bright evening star in the west soon after sunset; again as a morning star in the east before sunrise. The wonderful brilliancy which makes this planet so beautiful is an annoyance to the astronmer, as it masks the fine details of the surface and makes minute rtudy very difficult. As the planet, furthermore, is so near the horizon in the morning or evening that its image is distorted by refraction and obscured by haze, it can only be observed at all satisfactorily in full Venus is nearly as large as the earth and, as it is much nearer the sun, its temperature must be higher than that of the earth. The average temperature is estimated to be about 140 deg F Various nha

nomena appear to indicate that the planet is surrounded by a comparatively dense and cloudy atmosphere which, indeed, is apparently seen as a luminous dense which, indeed, is apparently seen as a luminous feet on the transits of Venus over the sun's disk, which occur our twice in a century This dense atmosphere trought reflects the sun's rays and thus prevents the surrounder from attaining a temperature to the planet from attaining a temperature to rations pale and indistinct markings, bright spots, which carry possibly represent snow, have frequeptly benchmark of the planet would be regarded as habitable, except for the mystery which have still surrounder its needs of the control of the mystery which were the control of the mystery which were the control of th

"The rotation of a planet can be detected and measured by following the movement of the markings upon its surface. In this way we have learned that Mars rotates on its axis in 24½ hours, and Jupiter in 8 hours and 55 minutes. The markings of Youns, however, are not sufficiently distinct to enable the time of rotation to be certainly determined. Some*fautronom ers have deduced a period of about 24 hours; but others, including Schiaparelli, have bees led to conclude that the period of rotation is equal to the period of the revolution about the sun and is, therefore, about 25 days. If this is true, Youn shus always greecest

the same face to the sun, as the moon does to the earth, while the opposite hemisphere is exposed to elernal cold and darkness. Such a planet would evidently not be habitable, for the surface of the hemisphere turned toward the sun would be white hot and the other hemisphere would be intensely cold. Surface Arrheduius has pointed out that the plainty issuits atmosphere of Venus affords evidence that the planet is not in this condition, for a permanent atmosphere can exist only on a planet which enjoys a regular alternation of day and night.

"Very interesting observations connected with this question have been made by the celebrated American astronomer, Percival Lowell, who is an acknowledged authority on the surfaces of the planets. From six

The illuminated hemisphere of the planet Venna, with a same on the light side of the planet Venna, with a same of the planet Venna, as sa

From Reclams Universum.

VENUS, IN THE LIGHT OF PROF. LOWELL'S THEORIES

onths' continuous observation at his observatory in Fingstaff, Arizons, Lowell concludes that Venus always turns one face toward the sun, and also that the apparent high, dense and cloudy atmosphere has no real The appearance of a strongly reflecting atmosphere is produced, in Lowell's opinion, by stre of dust. The illuminated face of the planet must be intensely hot, while the temperature of the opposite ide of the hemisphere cannot be much above the abi lute zero (-273 deg. C. or -459 deg. F.) On the illuminated side, the originally damp soil must now be dried out and cracked, and the opposite side is a This icy surface reflects the light of the stars and their images, which are frequently seen faintly when Venus, which passes through the same phases as the moon, appears as a thin crescent. the unilluminated side of the planet, in con of the very low temperature, the air must be con densed and precipitated as ice, producing a diminution of pressure which causes air to flow from the illuminated hemisphere. This incoming air is in turn condensed, and so the process must go on until the entire atmosphere has been precipitated. This condition has already been hearly reached. The air, rushing vio-lently from the light to the dark side of the planet, carries with it clouds of dry sand and dust. His the simoom of the desert. These dust clouds resident the sun's rays and thus simulate a dense and cloudy attrasphere, and thay also appear as streams and apole.

"According to Lowell's recent observation, therefore, our beautiful neighbor planet must be as lifeless as our still nearer neighbor, the moon, and for the same reason."

George Westinghouse on the Future of Electricity

I N an address before the Southern Commercial Copgress at Atlanta, Ca., Mr. George Westinghouse Grew the following vivid picture of future possibilities of

electric power:
"The application of power has
been the fundamental factor in
bringing about the characteristic
conditions of the era in which we
live. The steam vessel and the
steam locomotive, by revolutionaling transportation methods, made
possible the present development of
our country. It is the power of the
steam engine or the water-wheel
loom for the hand loom, with all the
marvelous results which have followed. Similarly, throughout nearly
every industry, human mucle is gelonger the source of power, for the
hand now directs and controls he
untiring and unlimited power of
greate engine.

"Had a Jules Verne sough imagine some universal serv t of mankind, he would well have de picted .some magic .agent vould apply Nature's forces to de man's work: which could take the rgy of her hidden coal, of the air, or of her falling water, carry it give the light of a million candles, the power of a thousand men, or to move great loads faster than horses could travel, to produce heat with out combustion, and to unlock chembonds and release new mat ials. No such wonder was nictured by the imagination of the seers of the past: and yet a subtle force which transcends the powers of the imagination is daily doing all these things. First the toy, and long the mystery of the scientist, electric power is now a familiar tool for the complishment of the work and the se of the comfort and pl

ure of mankind.
"During the twenty-five years in
which I have been intimately interested in the electrical art, a
development has been witnessed
which has surpassed the most optimistic predictions. Even before
the had been operated electric are
had been operated electric are

that period there had been operated electric are lighting circuit of high voltage, extended over rether large areas, with the presence upon the wires of from 3,000 to 7,300 volta, which practically demonstrated that considerable electric power could be cheapity ransmitted if means could be found to utilitie safety high-voltage electric current for power and light and for other purposes, but such means were not the known. It often happens, when something is greatly needed for any great purpose, that as a result of a raises in due source laventon or discovery which will be a source laventon or discovery which meet the demand, and so it was in the nature of invention and discovery which gave as a simple state device, constating of two coils of copper wire surrounded by abests of tron, which could, without an appreciable isse of energy, transform elberating elsetric currents or high voltage and areas! quagnots to tite, that low voltage and areas! quagnots to the, that low voltage currents of strong statetity, asply available for all power, light, head unit other surposes.

other purposes.
To the part I took in bringing derived in the Wall of the hast century the alternating convent spines of should purpose the should purpose the should purpose the spinester and discription. I seen such it set all of the equivalent accorded by the as one of the

similars in what is now a great and important

the a mentic of the development of the alternating correct and of peace of experience in the manufacture of electric tenustratures and of insulators for supporting electric condectors, power is now successfully canassisted by alternating current over distances of two business timescentible places wester out the coming of engiance; and of capital to be made available for industrial purposes.

"It is estimated by those who have made a study of the sources of waterpower of the Appalachian mounnaise, that there can ultimately be developed from 5,000,000 to 7,000,000 horse-power during the dry season of the year, and a much larger quantity at other times. This great water-power is brought by nature to your mountains and allie in widely varying quantities and will continue indefinitely; but the maximum and minimum flow of the waters of your rivers can be affected by the works of man and by a wise conservation of your forests.

"Notwithstanding our familiarity with the present uses of electricity, few of us really comprehend how universal and fundamental is the part which electricity is destined to assume in the life of future generations. Electricity is a universal means of applying power for doing the physical work of the world. It is effective not only in the application, but in the production of power. Less coal is required for producing electric power on a large scale than is required when many individual engines of smaller size are used. Water-powers which otherwise would be unavailable are made useful for supplying power to distant cities, and even smill tooked at a water-power will give-fector service when it uses the electric drive. Electricity affords a simpler, better way of doing many things with which we are familiar, and it also makes possible new methods and new developments which, without it, would be impossible.

"With electric power the mill can draw its energy from any stream within a radius of a hundred miles or more; it may be located on high and healthful ground, on the outskirts of an established town or city where labor is plentiful and transportation facilities are the

"Furthermers, the use of electricity will consense
the coal deposts of the world for those industrial priccesses in the performance of which it may always be
an indispensable element. To illustrate what a conservator of the coal resources of the country water-power
may prove, I will only mention that to produce for ten
hours such day from coal the fire million horse-power
which may be developed from Southern water-powers,
would require, with the most efficient kinds of engines,
not less than twenty-five million tone of coal annually.
If there were no water-power available, methods would
be adopted for producing power and conserving heat,
which would effect a saving of over one-half of the coal
mov consumed in the world. Here is a field for agitation against waste of our natural resources surpassing
all others in importance.

"Here are subjects not to be circumseribed by the wisdom and judgment of one man, but calling for the united ocunnel and effort of the wisset and best among an —requiring not merely the knowledge of the scientist, the skill of the engineer and the waith of the capitalist, but also the broad view, the enlightened experience and the high endeavor of our greatest states—man.

"In 1984," some experiments were made in England with the co-operation of Sir Oliver Lodge, the eminent English scientist, in the stimulation of plant growth by electricity. It has been brequently observed half growth is stimulated by electric light, and numerous experiments have been made having for their object the attimulation of the soil by the application of electric current. The experiments reported by Sir Oliver Lodge in a privately printed brockure on Electricity in Agriculture are briefly as follows:
"Two tractor's fand about twenty acres each were similarly sown or planted. On half of this land police with the second of the seco

"Two tractard had about twenty acres each were similarly sown or planted. On half of this land poles with insulance were exceed to support the electric wires, only one pole per acres being required for the purpose. The electricity required was produced by a small dynamic circum by a two-horse-power oil engine and was transferrined to a tension of about 100,000 volts of very high trequency. The experiments, which extended over several years, gave remarkable results, an intrease of from 10 to 40 per cent being secured in what crops gream on the electrified plot as compared with fide army positioned on the undestrified plot. Moreover, the short-pixel wheat was of a better milling and festing electric at at occasionably higher price than they given on the authoritied plot, film-law of the production of the substitution of the substitution

produced, while with five-year plants the increase was 86 per cent.'

"In writing to me on this subject in response to my request, Sir Oliver Lodge suggested that the results attained in the experiments referred to and in others would justify an elaborate series of experiments. These experiments could be usefully understan at the stations under the control of the Agricultural Department.

"An explanation given for the excitation of vegetation by these high tension currents is that high-frequency electrical discharges favorably affect the deposit of the nitrogen in the atmosphere into the soil, upon which deposit vegetation so largely subsists.

"Whatever prevents disease and insures health contributes not only to man's happiness, but also to his efficiency, and it appears that the electric current is to play a very important part in this field

"The outcome of the efforts of one who specializes in any particular kind of apparatus is often interesting. The development, by Doctor Peter Cooper Hewitt, of the mercury appor lamp has provided a light which is the least fatiguing to the human eye of all artificial lights, and experimentation with this lamp has led to the development of several other uses of the mercury vapor are, one of which is the production in quarts tubes of ultra-violet rays, the effects of which are tubes of ultra-violet rays, the effects of which are likely to be of the very highest importance in our daily lives. While these ultra-violet rays are emitted in the quarts tubes, they are effectively neutralized by the glass tubes which contain the mercury vapor used in lightling.

"One of the important uses to which these ultraviolet rays have airrardy been put has been to absolutely sterillize water, however much it may have been contaminated by bacteria. Experiments have also shown that the ultra-violet rays will sterilize milk without the application of beat in such a manner that it can be kept in properly sterilized vessels for long periods without deterioration or loss of its food values.

"With the growth of population, the pollution or rivers, and the contamination of the water supply upon which our population must rely, and the difficulty of determining whether the water and milk we use are free from notious bacteris, this safe and thorough method of significant becomes of inestimable value. Take although experiments and demonstrations which have already been made at the Sorbonne, in Paris, jad at the City Water Works of Marseilles, Prance, have not only proved the feasibility of this method of strillisation, but have brought out the fact that a 15,000-kilowatt generator of electrical energy could sterilise, by means of mercury vapor quarts lamps, as much water as is actually used for drinking and cooking in the United States.

"The simplicity of the apparatus for sterilizing water is such that there is no doubt but that it can be advantageously installed in factories and other places, and even in dwellings, adjacent to the point or points where the water is to be used, thus avoiding any possible contamination between the point of supply and the point

"The electric energy required for the operation of a quartz mercury vapor lamp used for the daily sterilization of 85,000 gallons of water is about equal to that required for half a dosen ordinary incandescent lamps.

"Not only have water and milk been sterilized, but in other experiments, also carried on at the Sorbonne, it was found that new wine was affected in a manner to give it the qualities normally attained in years, or an age of apparently many years was given by a few seconds' amplication of the ultra-violet rays.

seconds' application of the ultra-violet rays.

"These experiments and investigations suggest that
uses for the ultra-violet rays will be found which have
not yet been conceived.

"An important use of the mercury vapor apparatus has been to transform or rectify alternating currents indicate that this can be done on a large scale with a conditional saving of electrical energy. These promising results foreshadow the disapparatuse of the costly rotating apparatus which is now used for that purpose in the operation of railways and for purposes where the use of a continuous current is advantageous.

The transmission of electrical energy through the atmosphere without wires has, in ever few years, so first advanced that wireless tolegraphy is now an important feature of our daily life. We read of instances where wireless messages have been received at a distance of over three thousand miles from the point at which they were sent, and it is said that we shall shortly have ragular wireless communication between Paris and New York.

"Not only has it been possible to communicate by wireless in the Morse code, but it has been found that, with suitable apparatus, telephone conversations can be carried on over considerable distances, and it is expected that by improvement in the apparatus, thorse coughly practical results will before very long be

obtained. Investigations, of which there is aimest daily mention in the public press, indicate such great simplification in wireless telephone apparatus that we may, within the quite near future, have placed at our disposal a simple portable apparatus which will permit wireless conversation to be carried on over a considerable area. This will prove of great value in sparsely settled districts.

"It may interest you to know that the frequency of the electrical waves sent out by some forms of wireless transmitters approaches a million per second, and that by either an increase in the amplitude of these vibrations or by a more sensitive receiver, the distance over which these waves (which undoubtedly extend to an infinite distance) may be recorded, can be greatly increased

"In an experiment made by Doctor Peter Cooper Hint an experiment whelees transmission apparatus, including a mercury vanor interrupter, it was found that the effect of the high-frequency discharge upon the ron in the building occupied, such as water and heater pipes, gutckly produced incipient fires within the room where the apparatus was erected, thus demonatrating the wonderful power of this incomprehensible force and suggesting great possibilities in the transmission of electrical energy without wires.

"The transmission of electric energy without wires, which will be especially valuable for signaling purposes and for the control of machinery at a distance, will undoubtedly play a most important part in army and navy operations

The advantages of co-operation in the matter of the development and supply of electricity, having regard to a lessening of the cost and insuring the certainty of supply, cannot be overestimated, and those already secured by operations on a large scale are well known. Further co-operations in this great work for the benefit of the public, if not voluntary in the future, should, in my onlion, be an enforced one, notwithstanding the outery which has been raised by the ill-informed with reference to an imaginary monopolization of the water-power of the nation. Encouragement should be given to the investment of capital in the development of these enterprises under such wise and reasonable required to the capital insure economy in the construction and operation of plants, adequate returns to the capital invested, and at the same time protect the consumer against exorbitant rates and charges or unfair discrimination.

"In the larger industrial developments which I forsee there are other important factors which equal in importance the development of the water-power resources upon which I have dwelt I have particularly in mind those existing restrictions which make it difficult and expossive for a small corporation to carry on conveniently and in a simple manner its business with ramifications in several States, which restrictions, however, the great corporations of the country can easily surmount by reason of their financial ability to organize separate subsidiary companies in those States where such an expedient is rendered necessary to meet legislature requirements."

Pure Science and the Public Weal

THE proposition that practical results are the sole justification of the pursuit of pure science has a vast army of adherents, ready at every moment to uphold by word or deed their article of fath. If, therefore, this side of the question requires little further support, there is all the more reason why we should lend an attentive ear to the voice of those who, perhaps with broader mind and deeper insight, proclaim the supreme importance of pure science and its fuller justification. Let us then give head to the able advocacy of Prof. Bedgwick Mintot.*

"We are so accusiomed to the practical advantages that have followed from abstrues science, that we connect them with their source only by a distinct mental effort. The wonders of practical science have been recited so often that their reterration has become tedious, and we no longer feel strongly impelled to felicitate mankind on the parlor match, the telephone and the antitoxines, although we indulie at present in an unsubdued excited anticipation of wonders to come, especially in the domain of medicine Are we not all on the watch for the announcement of the cure for cancer, and vaguely for other new and actuading reliefs from disease. Such concentration of interest upon novel practical results is not wholly favorable to science.

"It is true that a large amount of investigation is going on which aims to secure immediate practical results. In chemistry and medicine especially the activity in the work of applied science is very great.

(Continued on page 317)

^{**}Batract from the vice presidential address delivered be ore the Section of Physiology and Experimental Medicine f the American Association for the Advancement of lotence, at Minnespolis, December 29th, 1910.



[The fluitor of the Home Laboratory will be giad to receive any sug-estions for this department and will pay for them, promptly, if

Photo-micrography for Amateurs

By Norman Bardon

PHOTO-MICROGRAPHS are pictures of minute or

microscopic objects that have been magnifed.

A micro-photograph is a microscopic picture of a object that can be seen with the unassisted eye.

The two terms, photo-micrography and microspic otgraphy, should not be confounded, as their mean-ings are very different. Photo-micrographs show obings are very chartest. Frommirrographs show or jects and their details which are far beyond the reach of the unassisted eye; while microphotographs are oddities of the art of photography and are made to be viewed through the microscope

There are two ways in which photo-micrographs may be made, namely, by using a single lens with a short focal length or by photographing the object through the whole microscope, i. e., photographing the image cularged by the eyepiece. In the first case the eyepiece is not used at all, but in the second case the eyeplece is left in its position. It is this last similar position. This is accomplished by least the retort stands as supports for the camera at the right height, restore the less said open a camera at the right height, restore the less said upon a camera at the restore the results of sand upon a camera at the restore the results of sand upon a camera at the restore the results of sand upon a camera at the restore the resto camera at the right height, receiver the lens and open the shutter. Fut a few grains of sand upon a filial silide, place upon the stage and then focus the miter-scope upon them. Then held the camera in side a position that the eyupless of the microscope agil the camera shutter nearly touch each other. Now adjust the retort stands so that they will support the camera in this position. Lesert the ground glass in the camera and very slowly draw out the twhe of the satcroscope. Soon a sharp image of the stand will appear upon the glass. Then the retort stands may be readjusted to hold the camera so that the exmera shutter is admits an eighth of an inch from the expelses of the microscope. This distance ought to allow room enough for the various adjustments that are required for the focusing of different objects. The diaphragm of the camera may be adjusted to exclude any light which might enter around the eyepiece. If possible have the eyeplece slip into the socket used for the lens, as this insures a light-tight fit. The drawing gives a clear idea of the arrangement of the microscope and camera. After the apparatus has been arranged, it will be necessary to put the reom in a proper condition.

The room must not be too light. If sunlight is used, it is best to have all openings darkened except one through which you receive your light. artificial light is used, have all other sources of light actuated light is used, have all other sources of light out off. The same room in which the photographing is done can generally be made to serve as the dark room. Do this, if possible, as it will save a great deal of walking as well as time. Having put the apparatus in a fixed position and the room in a prope

Parhaps the contest appointments to the house fig. This fig contains decement in the eyes, the tougue, the wit Wings may be mounted, dry between a fly's log it is a few days in a solution of caustic potes then mounted in Canada balesis.

then mounted in Danielo balants.

These are been of the accompanying photographs shows a few bleed corpusation. These are best mustade by placing a drop of hissed on a side and these governing it out over a large area by fragging another side over it. Do not press or sise the delicate corpusates will be crushed. After the blood is dry e good fall may be plotted out and photographed.

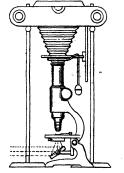
Sections of wheme of places often spield very prestry negatives. The sections of the margoid stem, shown betweeth, whe cut by placed with an ofcinary resort blade. The cutting was charried on under wrater, as very this sides out in this manner. It is best to mount the sentions in water so that the only will be transparent. Sections of wood may also be made in the same manner. All sections, however, must be out very thin so that the light can be transmitted through them, unless reduced, light is to be used. In conclusion, it may be said faint there is an applicated supply of objects for the photo-micrographer, many of which are beautiful as well as exceeding. pher, many of which are beautiful as well as exceingly interesting.



Tip of a fly's wing.



The leg of a fiv.



Apparatus for making photo-micrographs





Section of a meetwolf stem.

PHOTO-MICROGRAPHY FOR AMATEURS

named method that will be described here in a brief There are many ways in which the arrangement of the apparatus can be modified and, no doubt, many microscopists will modify the arrangement to The arrangement of the apparatus their benefit described in this article has been successfully used for photographing many microscopic objects, especi ally transparent objects

The very first thing to take into consideration is the source of light Either gas or sunlight may be The writer advises the use of light from a gas mantle The reason for this is because the light does not vary, and once a correct exposure is found it will apply always But with sunlight it is different There are a great many variations to contend with, and besides, exposures can not be made at night; while when using gas light, exposures can be made at any time. The light from an ordinary lamp or an electric light may also be used Having determined from what source you are to receive your light, the fixtures and apparatus should next be taken into consideration.

A low table which rests solid upon the floor is best to work upon. If gaslight is to be used, place the burner at one end of the table. If sunlight is to be used, place the table close to a window facing north. ver use the sunlight direct, but prefer the light re-cted from light and fluffy clouds. After the table and gas burner have been put in position, place the microscope upon the table in such a position that the microscope upon race used in succe a position that the reflector will receive rays from the brightest portion of the light. The best distance from the gas burner will be about two feet, New, since the optical ratis of the microscope is in a worked position, it will be necessary to put the optical axis of the camera in a condition, the photo-micrographer is ready for male ing photo-micrographs.

Focusing an object which is being photographed through the eyepiece requires a very fine movement of the microscope tube. Place the object on the stage, get a rough focus upon it. Now place the object in the center of the field. Then get a fine focus upon it and regulate the intensity of the light by means of and requiste the intensity of the light by messas of the disphragm beneath the stage. Try to seeker an illumination which best brings out the destalls wanted. If reflections from the times surface of the other of the microscope are found, put is a crifficiary of dead black paper. Care must be then to have wavey less clean and dry. When the object has been placed focus has been obtained, everything is resided for the armonyments. the exposure.

There are no rules that can be laid down in recent to the length of exposure. The smaller must learn to judge this by the brightness of the finance. length of exposure also depends upon the light used—sunlight or artificial; the power and angle of the objective and the distance of the from the eyeplece of the microscope. for an amateur to do is to keep the distant the plate and the eyeplece constant through his exposures, until he knows the correct exposing that distance. Use one kind of his not try first sunlight and then artifless, complete record, of every plate. It will see in flating the correct lints for photographs

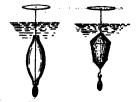
objects.

After the plate is exposed, develop it is first developer and develop until the outlines of the same clearly seen from the back of the plate.

Simple Hydro-comparators By Frederick William Salm

WAS very pleased to see upon page 524 of the Scientific American for December 51st, 1910, a description of a very simple hydro-comparator

I have on various occasions used a very similar de



vice, except that I have made mine in other ways that I believe have advantages over the style that you describe.

I have made some out of very light glass tubing, heating it and blowing in it and so producing a kind of a bottle, shaped about like a fishing float, passing heating it and blowing in it and so producing a kind of a bottle, shaped about like a finking foot, peasing a fine wire through it, and seating this wire in it with parafine, and to the lower end of the wire seaturing a small fishing sinker, and to the upper end a small fishing, and to the lower end of the wire seaturing a small fishing sinker, and to the upper said lower ends of the order control of the core, very much like the case you feet thed, except that I have always been very careful? to make the upper said lower ends of the order closely, and at a fashing sinker to the bettern and of the wire, and then parafine, the whole insurviness up to the parafine of the upper wire for very nearest the parafine of the upper wire for very nearest the parafine of the upper wire for very nearest the parafile of the wire peasing discoping like float, then afthers of various weights may be used with one float; and thus a much length variety work of work of the control of the

to be the form the state of the state of

Curiosities of Science and Invention

published a photograph of a in a bottle. This was of foreign



CLOCK ASSEMBLED IN A FLASK

George W. Wharmby, a native of this city. The dial of the clock consists of a ship's wheel 5 inches in diameter. while the clock movement is contained in a barrel 21/2 inches in diameter. Yet the neck of the flask containing the clock is less than an inch in diam-To assemble the clock, it was divided into sections small enough to be introduced through the narro neck. A wooden platform was erected nece. A wooden platform was erected in the flask, and on this the ship's whesi was put together in horisontal position, the parts being connected with acrews, after which it was raised e vertical position, and the spoke handles were fitted in and glued in place. The cylinder or barrel for the wements was introduced into the in the form of a flat strip, and a bent around and fastened topether with screws. The back of the the shape of the neck, and then straightened out after being introduced into the flack. The works are suspended from a cross piece fitted into the neck of the flask. A ratchet system is employed for winding the clock and setting the hands, and this may be reached by the rod shown at the side of the bottle.

Novel Log Skidding and Loading Machines

T is undoubtedly true that the most racking strain to which a holsting engine can be put is in skidding or "snaking" along through the timber. The engine

arily work at high speed to accomplish satisfactory results, and the nature of the work subjects it to frequent and extrem ly severe shocks. An interesting machine of this type is shown below. This ma-chine is equipped with two hoisting engines of two drums each, especially de signed for the purpose, one of which is used for skidding logs to the track for a distance up to 1,000 feet and the other located near the foot of the boom having one drum for carrying the hoisting or loading line, and another or front drum for hauling or "spotting"

the cars up the inclined track and through the machine. The machine is provided with a frame which is carried on two-wheeled trucks which are connected to the skidding engine above mentioned by means of heavy steel sprockets and chains, thus making it self-

(Continued on page 817.)



A YOUTHFUL genius of Los Angeles, California, has constructed the railroad motor car shown in this photograph, for the exclusive use of himself and



MOTOR CAR BUILT BY A BOY IN LOS ANGELES, CAL

his friends, and almost any Saturday afternoon it may be seen whizzing up and down the stretch of track near his home. This ingeniously contrived our is constructed of four iron wheels, a few lengths of 2×4 . and the engine from a disused motorcycle. The gaso-

line tank formerly contained maple syrup, and the tool case is neatly adapted from a soap box and contains a tack ham mer, a bicycle wrench and a beer bottle full of lubricating oil.

tie full of lubricating oil.

The transmission on this homemade car consists of an old leather
belt, presumably adapted from an
outworn harness, which connects the
engine in the center of the car with the war axle

In spite of its apparent crudity this little motor car has the one prime requisite of success-lt works.

The Electro-magnetic Ear

W HEN a person wants to tele-

not where, he will call in electro-mag-

netic voice which will be heard loud by him who has the electro-magnetic ear but will be silent to everyone else,"

said Prof. Ayrton fourteen years ago. His prophecy is coming true. Wireless

apparatus, particularly the receiving apparatus, is so simple that one can

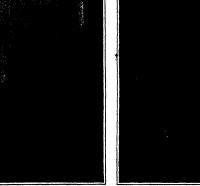
readily carry it about his person. A man in Philadelphia uses a portable receiving apparatus, comprising a

pair of telephone receivers, a detector and tuning coil It is quite apparent

from the expression of the man that he is sorry that he cannot talk back.

An impromptu antenna.

Manhole as a ground.



THE ELECTRO-MAGNETIC EAR



mile through the binding michine + STARTE SELF-PROPERING LOG SKIDDING AND LOADING MACHINES

Machine with trucks raised to leave a clear track.



The Inventor's Department

Simple Patent Law; Patent Office News;

Inventions New and Interesting

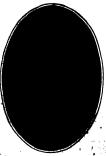


The International Protection of Industrial Property

HE interests of the United States of America will be in good hands at the congress of the International Union for the Protection of Industrial Property, that convenes in Washington, on May 15th, next. In the selection of delegates to the manufacturers and inven tors of this country at this very imp ant assemblage, President Taft naturally wanted men who had accomplished son thing in the field of their chosen profe sion. The men who are to sit in the Mas Congress will be empowered by their re-spective governments to sign treaties, and ents to treaties, relating to protection of industrial property; and while all such treaties are of course, signed subject to ratification by the adhering nations, it is essential that the delegates who sign them thus tentatively must know the situation thoroughly and have at their finger-tips the needs and ssities of their own constituencies. They must have a knowledge of what has been done; opinions as to what should be done, and the firmness to protect their own nations on every point.

The periodical conferences of the union have taken place heretofore at Paris in 1880 and 1883; at Rome, 1886; at Madrid, 1890 and 1891, and at Brussels, 1897 and 1900. In the preparation for these conferences the Bureau Internationale at Herne, with the approval of the admini-stration of the country where the reunion is to take place, prepares propositions to be submitted to the latter, with statements of reasons or arguments. When propositions, the Bureau Interna tionale sends them to the governments of the other nations adherent to the union asking them to prepare propositions and having been born at North Anson, Maine counter-propositions. These are all print December 35th, 1851. He claims Michied and distributed among the adhering nations prior to the date of the assem bling of the conference.

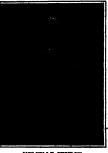
The number of delegates each gove ment, may appoint to represent it at the states being the host, Mr. Tatt selected five men prominent in the world of patents. The appointments of the Commissioner of Patents, Hon. Edward B. Moore, Mr. Frederick P. Fish, Mr. Charles H. Duell, Mr. Melville Church, and Mr. Robert H. Parkinson, were announced last A portrait of Commissioner Moore a bublished in these columns only two



C. H. DUELL

necessary to add his picture to the portraits here published.
Out account of his position at the head

of the United States Patent Office and be cause of his wide knowledge of patent matters, both domestic and international, through nearly a third of a century's asso experience in the negotiating of foreign aties, Mr. Moore was selected as chairman of the American delegation. In this capacity he will make the opening address



MELVILLE CRURCH

hen the Congress assembles. Upon him sided by his committee, devolves the duty f selecting the place of meeting in Wash ington, and the entertainment of the dele gutes of foreign nations and those who company them,

Mr. Moore is a son of New England, ents settled in the Wolverine State when he was still in his boyhood. Commits sioner Moore was a page in the United States Senate at the beginning of his ca reer in Washington, and was educated in the law at the National University Law School, entering the Patent Office as an assistant examiner in 1883. He was suc cessively law clerk, principal examiner. and assistant commissioner, and his appointment to the post of Commissioner of Patents on June 1, 1907, was the first time that a Commissioner of Patents had been appointed from within the ranks of the Patent Office. Mr. Moore was special com missioner to the Paris Exposition of 1900, and delegate to the International Confer ence for the Protection of Industrial Property at Stockholm, in 1908. The epartment dispatched him to the nine principal capitals of Enrope in the fall of 1909 to negotiate reciprocal patent protection, and in the summer of ,1910 he was again obliged to pack his trunk for foreign parts, this time being commis-sioned as "expert attaché" to the American delegation to the Fourth Interna ional Conference of American Stat Buenos Aires, Argentina, where he was instrumental in securing the adoption of Instrumenta in securing assessment of the control o

on it seems un-| firm rein on the Patent Office. His administration has been productive of many badly-needed reforms. He never gives up fighting for what he thinks is right and needful and has the reputation at the Capitol of getting pretty much what he wants. He realises that the Patent Office being self-supporting and enjoying a huge surplus as the result of the payment of fees by inventors and manufacturers, is entitled to the best facilities for doing its work. Just now his energies are bent on the success of the Congress of the In-



ternational Union in May, but he has not lost sight of the fact that the Patent Office needs more room, and he intends, as seen as the International Conference is over to put his shoulder to the wheel and duce the Sixty-second Congress to let him spend, some of the Patent Office surplus for a new building.

Hon. Charles H. Duell was Commis sioner of Patents from 1888 to 1801. His administration was the last, but one, prior to Mr. Moore's appointment. Though he is practising patent law in New York, he is still a familiar figure at the Pater Office, where he often drops in for a busi ness or social chat with his former ass ciates. Mr. Duell was born at Certland N. Y., April 18th, 1850, and studied law as Hamilton College in 1872; receiving the degree of Doctor of Laws from his alms mater in 1906. His public career began as a mamber of the New York Assembly as a mamber of the New York Assembly, 1878 to 1880; as a patent lawyer he after-ward practised in Streamer, after his term as Commissioner of Passette paging in 1901 he became assistant, the same of the Republican National Commission, and in 1904 was appointed associate function of the Court of Automatic Str. in Engine of the Republican member associate insuce in 1994 was supported associate insuce in the Court of Appendix of the Education Columbia, to which selection of the County peals from the decision of the County that of Patents are taken. In 1996 1 was presidential electors blance New York, and served at provident New York, and served at New York and served at the State of the Next 1910 he was treasurer of the publican Congressional Duell married, in 1879, Mile Marr Sackett, and resides in New York. he is the senior member of Bu

as a writer on pat tributed an article on pate American Cyclopsedia of Last,

Frederick P. Fish, Req., was born at Taunton, Mass., January 18th, 1855, and received his education at Harvard, taking his tegree as Master of Laws in 1875. Mr. Fish is very modest in speaking of his to the frunt rank of our practitioners of patent law, and is a recognized author-ity upon the subject. He gave up his practice in 1901 to become president of the American Bell Telephone Company and later the American Telephone and Telegraph Company, which companies he served with distinction for six years, resquaing in 1907 his practice in Boston. Mr. Fish is a director in the New England Trust Company, the Old Colony Trust Company, the City Trust Company, all of Boston; is a member of the board of over-seers of Harvard, and chairman of the Massachusetts State Board of Education. He married, in 1876, Clara P. Livermore, of Cambridge, Mass., and makes his resi-dence in Brookline. He is a member of the Union, St. Botolph, University and Exchange clubs of Boston, and the Union, University, Grolier and National Art

Melville Church, Eng., of Washington, was born at Utics, Oneida County, New York, December 18th, 1856. His study of law was pursued in the offige of Lorender Hill, of Washington, and he also attends the Columbian University, new the Gener Washington University, receiving the d grees of Backelor of Laws, Master of Laws and Mester of Patent Law, and was ad mitted to the bar of the Supreme Court of the District of Columbia in 1879 and to the bar of the Supreme Court of the United States in 1882. Mr. Church is the professor of patent law at George We ington, a position he has eccupied the past sixteen years. He is much be by the students and a large nun of the younger patent lawyers of Wash ington, who beast of the honor of attend ing the Church lectures on natent law. Mr. Church is married and has a large family. His son, Melville Church, Jr., is now associated with him in practice. Mr. Church is a member of the American Stor Association and is president of the Patent Law Association of Washington. He is a member of the Cosmos and Chery Chase

ciobe, Washington. Robert H. Parkinson, like Commissioner Moore, was born in Maine, and graduated at Dartmouth, before he was



St. and the office of Cross & principles in the second to be remainded to be remainded to be remainded. He practised for it is. Louis and was for a being helicitated atterney for the At-The lates and was for a facility of the At-Freedre Indicad Company, with control of the At-freedre Indicad Company, with control of the Indicade of Fisher & Sunces, of Cinginnati and New York, and suon the death of Col. S. S. Fisher, the head of the firm, Mr. Parkinson became the junior member of Hatch & Parkinson ati, helping to edit the sixth at the manner, selping to east the sixth volume of Fisher's patent cases. In 1893 Mr. Parkinson removed to Chicago, leaving his brother in possession of the Cincinnati offices. He is at present the sen-

for member of Parkinson & Lane.
Most of Mr. Parkinson's profe life has been occupied in patent litigation, with respect also to trade mark and copyright causes. He has argued many cases in the Supreme Court of the United States and has appeared in cases in all of the federal circuits. He is a member of the American Bar Association, the Illinois Bar Association, and the Cincinnati Bar ciation. He is a member also of the Chicago, the Union League and the University clubs of Chicago, and the Law-pers' Club of New York. Mr. Parkinson sa never been a candidate for public

No one need fear that the best inter-ests of the manufacturers and inventors of the country will not be upheld by the five gentlemen whose personalities and careers have been above set forth. They are representatives of the highest circles realm of patents; they are sound in their views on the rights of applicants and patentees, and the distinguished henor which President Taft has conferred on them has been richly deserved, as tory of their achievements will elo

e of inves First Asts, enjoys associates and the in patent a, and the of the py file plicate pliment to his humoristic schieve-

ments. But, as distinguished from his was making a trig ins in the pure

1 de fa-

oticed that the statement or protest-mus be verified, that is, it must be sworn to, and the information of the pendency of en volu the application must have b ily communicated by the applicants. This should clearly appear in any protest as the Patent Office rule makes it a necessary part of the statement or protest.

The Universality of Invention.—An experience extending over many years impresses the writer with the fact that invention is common to all classes and that it is accompanied invariably with great enthusiasm. Only a few days ago in a street car the writer sat opposite a man evidently in humble cirnodel of some contrivance and he looked at it with the eye of a lover. And so it is with them all. Whether millionsire opper king, patent medicine man rolling in wealth, negro porter, or a negro client the writer once had from the South, who looked like a descendant of one of the African kings and had a very ingenious improvement in compound engines, they are all characterized by an enthusiasm that endures. And this is one of the great charms of the pursuit, the creative character of invention operating to maintain the interest and absorb the attention of the inventor. Financial failure does not detract from the pleasure of invention, for the inventor often states that the pleasure he had experienced in pro ducing an invention well repaid him for the effort, even though on completion it was found to have been anticipated by

Wanted: A Method of Destruction Some features of modern construction add new problems to the problem of building. new presumes to the proton or collising. This is particularly true of concrete con-struction and Supercolling. Ordinarity the life-see hundring. Supercolling for instance, is from twenty-flow to Enlyr Are years. Building as constructed a score of years ago can be wrecked at little pr no expense, squetimes, in fact frequently, rielding a small profit from the reclaimed yielding a small profit frein the reclaimed makerial over the cost, of tearing down and hauling away, "The other day it be-cause accessing its like instead of impro-tance in the conserve building, and the a-cutal cost: of wrecking it was \$22,500. Thus it will be section important factor atterns into the consideration of plan form of construction. In addition the way to a of construction, you must also garden. inters into the security of control of construction. In addition, the security of control of contro

arly ne was Dig Mer Graham the investment for desphone.

Well!" he see have been raising sheep all my life wan thousands of them now on the hills of _____, and that man now on the hills of _____, and that man has told me more about sheep than I ever

Dr. Graham Bell has pursued his develment of the rudimentary tests along spinent of the rudimentary cases arous with his experiment in connection with an effort to cause sheep to uniformly been tribut triplets, and litters, in which with the constitution of the cause sheep to uniformly been without the last back was a pre-told, considerate the cause assessment of the cause as a cause as a cause of the cause of t

RECENTLY PATRWIND INVENTIONS. These columns are open to all patentees. The kices are inserted by special arrangement this the inventors. Terms on application to the dvertising Department of the Scientific Mesican.

The weekly Index of Patents legal by the Unit States Patent Office will be found in the Scientis American Supplement.

Pertaining to Apparel.

Pertaining to Apparel.

OVERAILA— A knowns, San Pencisco,
Cal. Those overalls are designed for the use
of expressers and other mechanics and are
provided with a nail pouch capable of swinging freely and to hang vertically with a view
to prevent the nails from falling out of the
purch when the weaver is nailing and in story
ing positions, means being principles and
into the provided of the control of the
ing, to prevent free use of the hands when
sawing or in similar operations.

Electrical Devices.

Electronal Devices.

CLOCK OFFERATED ELECTRIC SWITCH.

J. W. Havass, Princeton, N. J. This invention provides a mechanism adapted to be actuated by a time mechanism: provides for connecting the alarm unchanism of an airm clock with the switch mechanism of an electric switch, whereby the switch is operated by the alarm mechanism as and when the same is operated to inadjurate or discontinuous interesting of the control of th

Of Insterest to Farmers,
TRANSFILATIVER—A. G. Jacoss, Jonestown, Miss. In this case the invention has for
its object the provision of a simple and incrpressive device by means of which the plant,
together with a sufficient make, may be trainplanted from one point to another.

Of General Interest.

Of General Interest,
BOTTLE.—TOMMA M. DANTER, 857-501
Jackson Boulevard, Chicago, Ill. The purpose
of the invention shown in the engraving is to
provide the provide shown in the engraving is to
provide the control of the control of the control
provide as a constant potent, indicating that
the bottle has been opened, which device is
automatically opsaided upon de removal, of
the copy and withdyawal of the cobe. The
coagingment described will in no way literities



with the files. The cettlement is seen to be seen to be

plate and on which the arm is mounted. FEED BASKET.—D. P. SAMMON, New York, N. Y. The sim here is to provide a beater made of wire club, reinforced, to maintain the work of the wind of t

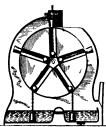
in upward or bactward direction.

POLE — P. W. Wickox, Igm., Com. This
inventor provides a pole consisting of an
cinegation body, preferably holicow and conteneds of Iron, with useas on the pole for
climbing the same and a fastered head formed
on the pole for receiving the supports adapted
to curry alectric virue, electhes times, and other
current conducting or supporting device.

CISTERN OR TANK.—A. B. CRAWF Eastings, Neb. The object bure is to pro-

under pressure, which will be of sufficient strength to resist the pressure, which may be easily cleaned and which will not leak, and will keep the water sweet and pure, and at practically the same temperature regardless of

the weather
DHINNING FOUNTAIN.—PREY A TORN-WALL and RICHARD M BOYD, HOUSED, Mass As a present constructed and arranged the public fountains are a source of danger due to their propagation of many forms of disease where insculation is incident to membraneous contact. The inventous shown in the limitate.



DRINKING FOUNTAIN

tion has in view to provide a fountain where-to the drinking supe are treated antisoptically during intervable between periods of use; and to provide a fountain with means for removing grease or other foreign substances from a drinking rup between the periods of use. An antisoptic solution is used, selected as beet suited to the removal of bacilii which might achieve the cup.

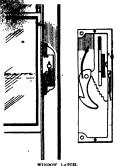
Hardware and Tools.

Hardware and Tools, SAPETY RAZOR—R. Kessum, New York, N Y This leaveston pertains in safety rasors, N Y This leaveston pertains in safety rasors, as a blade earlier adapted to have a renovable blade monarted thereon, a blade holder movally associated with the earrier and serving to secure the blade in place, and a guard for the blade, the guard assisting in securing the blade holder.

holder

HOME REPAIRER — T. H. Wirder, Warren,
Ohlo. The invention is an improvement in devices for use in repairing hose, and for searing the ordinary fittings to hose by means of
whre, and the invention has for an object to
provide a construction by which the wire may
be looped and earurd tightity around the hose
over the fitting or connecting devices, to sacurrly fasten the hose in place.

curry fasten the hose in place.
WINDOW LATUR. -Gasons Faz, Lynden,
Wash. The engraving represents a device for
relating window sasbes in predetermined pesitions. An object of the inventor is to proride a device for use in positively locking
giver the upper or the lower sash in any
sition it may be put. A further object is to
ide a latch which when shifted will perthe raising of either sash and will not
make a downward movement, so that the
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position, so as to permit the sash to have free movement up or down. The sash latch will work with shrunk windows or with window sashes which are loose

Heating and Lighting,
LIQUID FUEL BURNER.—J. J. VALUER,
Oakland, Cal This invention refers to the
provision of a burner for use in connection
with stores, heaters, and the like, in which the

jet, and which is provided with means for spreading the escaping furl and steam, thereby to form an effective flame.

to form an effective fame.

LIGHT FINTURE—M. F. FIFERMATRIN,
New York, N. Y. The object of this invention
is to provide a fixture for use with fragile
incanderent electric and other lights, which
is compact in form and attractive in appearis compact in form and attractive in appeartion, and which provides a resiliant support
for the light, and acts as a shock absorber to
protect the light from injury due to jarring
or vibration.

Household Utilities.

Bousshold Utilities.

PORTABLE (HAITING APPRATUS—H.
C. STOUT, Mt Hidney, Vs. in this patent the invention is a small, sauly portation, and fine-training the statement to a short, table leaf, or ledge, or to a vertical wall, for use in supporting receptacies for liquids or solids requiring to be heard. The supportate form an easily affecting the properties for the sixth continuous conductive mentions are for the sixth chamber.

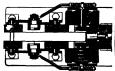
Machines and Mechanical De

Attachines and Machanical Devices.
APPOLATINE FOR MASAIRING THE
STRAM PASSING THROUGH A PIPE.—H.
BUTHERIBER, OE Königs Aller, Villenkonical
Grunewald, near Berlin, Germany. The object
of this investor is to provide means to rotate
a paddle wheel and to hold this wheel, a cone
adapted to be rotated by said paddle wheel
and an apparatus for adjusting the come in
accordance with the pressure of the steam.
Purther, to provide a preliminary chamber arranged in front thirty the steam passing fron
the chamber to the wheel.

FILETING SCERING —LOUIS N. LACOMEN.

the chamber to the wheel.

FRICTION GEARING—LOUIS N. LACOMER,
NET 66th Street, Brooklyn, N. Y. The lavention is shown in the engraving and relation to
certain improvements in friction gearing for
positively connecting driving and driven sharts,
and more particularly to that type in which
the driven shart shall be rotated in either



PRICTION GEARING.

direction in respect to the direction of rein-tion of the driving shaft. Pinions are em-ployed rotatable about radial sare for rotating the driven shaft in reverse direction to the driving shaft. One of the such nobjects is to amplify the central of these pinions, so that reverse the control of these pinions, so that RUAR REMOVER FOR CENTRIPUS MACHINES —R. P. JOHRSON, New YORK, This invention relates to a device for read walls of sugar separations. The object is provide a device which can be used; undisto the separating operations, with ing of at least 25 per cent in time sear and with the least distributed to the operative position without the operative one within the bowl, and the sugar from all parts of the bowl.

the sugar from all parts of the bowl. ACCURAGE WARPPING MAGNINE.—H D ROBINON, New York, N Y. This invention has reference to the manufacture of cables, particularly those cables used for supporting suspension bridges, and in which there are a large number of septrate strands held together and protected by one or more wrises or strands wrapped around the mins strands, to form an outer covering or casing.

outer covering or casing.

PAPPER PERBINO MECHANISM.—F. E.

Roannow, New York, N. This insecution
London, Mayland. This turestion relates to
mechanism for printing, folding, or the like
feeding mechanism comprising a spring arm or
arms secured at one end on a shaft and provided at the other end with a friction pad, so
that when the shaft is rotated the pad is
brought down on to the pile of paper sheets
to be fed with more or iess force and the
sheets are 66 depared one at a time.

Prime Movers and Their Accessories. ROTARY NOTINE—D. N. Gazar, Smbary, Ohio. In carrying out the present investion the inventor contemplates measure for pryouting the sudden descent of the abstract valve after the shots has passed it. Prime the principal state of the principal shots a passed it. Principal shots a passed it. Principal shots the principal shots the abstract, was a side for bringing about the abstract and the side of the sid

propelling finid, which may be child, onto pressed air, water, or any suitable medium; and to provide means for relating and lowering the abuttent vaive in order that the relating power wheel with its shoe may pass unforcath it

seath it SELF-OILING ARBOR FOR SEREL ROLL-ERS.—T. L. YOR, Edgedd, S. C. The main purpose of this improvement in twestie was charge, is to provide a chell roller arbor, with that he self-ciller, thereby doing away with the necessity of containty offing these rollers which run at a high rate of speed, and are, consequently, in frequent need of lubri-

RAWRYY CRANKING DRVICE .- Groups M BAFFTY CRANKING DEVICE,—GRORGE M. FIRERS, 189 North Park Street, East Orange, N. J. and ALBERT E. EMPLIFON, 284 William Street, Pittston, Pa. A safety cranking de-vice is shown in the accompanying illustra-tion. The invention has reference to starting he invention has reference to start and has for an object to provide



SAFETY CHANKING BEVICE.

safety cranking device for operating the piston of an engine preparatory to starting the engine. For the purpose mentioned use is made of a sleeve for engagement with a crank shaft of an engine preparatory to starting the engine properties of an engine preparatory to starting the collosely fit the first sleeve, cams on the sleeve and sadpated or engage, and spring controlled means removably and adjustably securing the said sleeves. means remo

said sievee.
"HROTTLE VALVE.—W. J. Lallar, Butte.
Mont. This invention provides a valve adaptde for use in high or low presance, wherein
the seating pressure is balanced; provides a
construction wherein the war of the operative member is minimized provides efficient
past the cut-off members; provides mensa for
preventing the leakage of steam,
past the cut-off members; provides mensa for
structure; and provides a compact,
directories and open and open and open and self-housed valve structure.

Ballways and Their Acco

Railways and Their Accessories, LOG AND LUMRER CAR.—C. H. Rucotzes, Hope, Ark. The object here is to provide a car especially adapted for use in logging and lumber railways, and consisting of a rigid frame, on which the load is carried, suppersed by a facility frame, This car is adapted for short curves, and crade agentirection of logging railways

RAIL FASTENING STYLE.—J. V. Bend El Paso, Texas. See Bergen provides i fastening and Assima for champing rails steel, concrete by composition railway without the use of bolts, seemy, splices



RAIL JOINT.

and including in the specific constructs sented rearwardly facing hooks located longitudinally beyond the extremity of the and the other in rear of the rail and depression the including the rearrangement of the rail and depression the upper surface of the trand of rail to avoid interference with the whoel fasquand whereby the rails when united will be interlocked at points beyond abutting made of ralis in both directions beyond said je

TAIN IN DOOR CHITCHOOL SO OFFICE AND THE ACT THE CAR TRUCKS.—JREMMINR J. SULLIVAN, OBJECT OF MARKWHILE, AND THE CHITCHOOL SO THE CHITCHOOL AND THE CHITCHOOL



CAN TRUDE.

ing strain and to relieve the flange passence on the truck wheels; to people a signing, place constructed and opening to bell the the frames and botter in classical to bell the

tide a recting connection for the spoting plants the date frames, and the state of the state of



RAILROAD TIE AND BAIL PASTENES

thus operate to retain the ballast between the ties, the sides of the latter presenting unin-torrupted faces throughout their length, which renders the tie more effective for this purpose.

Pertaining to Vehicles.

Perraising to Vehicles.
CARBURETHE.P. J. GODVELLE. E. H.
ANDUREDUM, and L. J. JORET, T. Bue de
Moulin Verf., Paris, France. The automatic carbureter presents this disadvantage, that for staring, the pure air flap valves are lifted and the fuel is not sucked in in sufficient quan-tity. The hand controlled on has this dis-advantage. When the motor must carri all its power it is necessary to opes actively the suc-tion inter of the motor. The latter they along add does not suck a sufficient country of froil. The present invention remedies these defects and consists in a device which combines hand sall esgenantic coggest.

sad automatic comprol.

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James, 131 go. See James, 14 go. See James, 14 go. See James, 15 g index, inda "greatcowns—wast i has expert advice immediately, to possible words. Inserts showing it elevation of a clussels, with all bered and named, add greatly to it ness and utility of the handbook.

berea and mixed, see greatly increase and cutified or of chambras. By F. N. Trans Chambras, C. P. F. N. Cutif. Ensire, Ph.: The Chemical Publishing Company, Eds. 1800.; 198 pp.; Hissistand.
Arisona is notsiby risch in trinsent deposition, and its mountains and cutions have been attacked with such estimated that the yield of specimens has been preparationalisty large and its the beauty and variety of the country present unusual factures. Validium, tumperen, and not/vicenum are byt uncommen, and only design the company of the company present unusual factures. Validium, tumperen, and not/vicenum are byt uncommen, and the chemical and positiogates conditions and the chemical and positiogates conditions and the chemical and positions of these deposits are given.

THE STANDARD FORMULARY. By A. Empl Hiss, Ph.G., and Albert E. Ebert, Ph.M., Ph.D. Chicago: G. P. Engel-hard & Co., 1910. Svo.; 1,256 pp.

hard & Co., 1916. Swa; L, 1,566 pp. The compliers have here combined in volume six separate works. The first part sixts of pharmaceutical preparations to sixts of pharmaceutical preparations to the German and the British Pharmace, The other Ter parts comprise formulas domestic and veterinary remedies, propriet remedies, performed and teller, articles, dress cutilities and beverages. The units of qua-terinary and the compression of the com-tact of the complete of the com-tact at the even plate of galact. New years and the paging system have been sub-



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LISTS OF MANUFACTURERS.

COLUMN COLUMN

Perachutes for Avistors

ued from page 200.) my. Its advocates are enthusi and have made many experiments. Some of these have ended tragically, as in the otte of the German inventor Hayn Others have been simply unfortunate without occasioning any injury except to the machine. Such instance is afforded by the recent test of the Reichelt apparatus at the Eiffel Tower, where the inventor, at the last moment, was happily inspired with the idea of replacir himself by a dummy. Still other experi-ments have been sufficiently successful to give great encouragement. Thus the experiments made by Tissier and Rollet at Vincennes have led these inventors to propose to construct an apparatus of practical size, large enough to carry a man instead of a guinea pig which was used in their experiments; and a man has been found courageous enough to offer to play the dangerous part of the

Those who are opposed to the use of the parachute assert that its application is impossible in practice. One of thes irreconcilables. Mons. Surcouf. explains his position in an article in Excelsior, which may be condensed as follows:

"The parachute of the ordinary type cannot render any service to aviation or aeronautics of any kind. It even presents serious disadvantages, whether it is attached to the aeroplane or to the body of the aviator. In a fall from a moderate height the parachute may unquestionably be useful, but in falling from a great elevation only by a miracle could the aviator derive any protection from its use. If the parachute is at-tacked to the aviator, how can he, confined to a limited space and either firmly attached to his seat or hampered in his movements by the parts of the aeroplane, free himself quickly enough to enable his parachute to act effectively? If on the other hand the parachute forms an integral part of the aeroplane, it must be opened either automatically or by the action of the aviator. Success in eithe operation requires a combination of circumstances which, it is no exaggeration to say, never occurs in practice. might as well assert that the aviator would be able to regulate every detail of his fall. Moreover, by imparting a false sense of security, the para-chute may lead the aviator to pay innt attention to his aeroplane and its guidance. The true parachute of the future will be the aeroplane itself which will certainly improve in strength and

stability, and consequently in safety."

Nevertheless the anonymous writer from whose article in La France Auto-mobile et Acrienne the present article is derived, expresses the opinion that, even with the most perfect aeroplane that even with the most perfect acrophane that on were he devised, safety appliances will be no more superfluous than they are on ships, which, no matter how per-fectly constructed, are provided with life boats, life preservers, and va-cibles devises for saving best

Constituted the thuring car ongine and make a powerful and substantial machine. These the cranistant weight 188 pointes not and was forged from a single billet of wantdium steel with a tensile strength of 130,000 pounds. The entire engine weighs sixteen thou-sand pounds and its pumps develop eighty-three horse-power. The contract specifications called for a pumping of pecity of seven hundred gallons a min-nte, but in the test made at the builthood neven hundred and fifty gallens of Hud-son River water were delivered and a on lever water were delivered and twenty-five seasons of one hundred and twenty-five seasons maintained.

daucă au pape Alf.)

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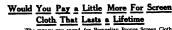
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Notes and Queries

(12403) S. J. S. asks how to clean

(12403) S. J. S. sake how to clean trushes. A. Dissolve a piece of sode in some bot water, allowing a piece the state of a water and the state of the water and out again, keeping the backs and handles as free from the water and out again, keeping the backs with a state of the state of the water and out again, keeping the backs with a town, but not the britate, and set the breathes to dry in the sun, on near the first with a town, but not the britate, and set the breathes to dry in the sun, on near the first with a town, but not the britate, and set the presents of a town makes them soft, as does also the use of scop.

(13404) W. L. W. writes: I have an idea for the generation of power without fuel, which I desire to submit for pour consideration if the idea between the sun of the state of the sun of



The arrough a pipe too inches in dismeter; and plan pipe in bottom of wheel pit, through which I town the pipe in the pipe in

water in the reservoir to force the water ba-ward, an energy is required sufficient to lift, the aftor-mentioned column of water. In se-cretance with the laws of hydrostatics, the size of the falset, that is to say, the area of Part and the laws of the highty of the mentioned limit rather and the highty of the memory of the laws of the laws of the force of the laws of the laws of the force of the laws of the laws of the the reservoir. The water whose causing sur-ersts more power in response to the falling water in the fume than the force represented by the hydrostatic pressure opposing the return of the laws of the laws of the laws of the water in the fume than the force represented by the hydrostatic pressure opposing the return of the laws of the laws of the laws of the water in the laws of the laws of the laws of the water in the laws of the laws of the laws of the water laws of the laws of the laws of the laws of the water laws of the laws of the laws of the laws of the water laws of the laws of the laws of the laws of the water laws of the laws of the laws of the laws of the water laws of the laws of the laws of the laws of the water laws of the laws of the laws of the laws of the water laws of the laws of the laws of the laws of the water laws of the water laws of the water laws of the laws of th

(12406) W. M. asks: Is there any (1240) W. M. BARE: It here any metal that is a non-conductor of heat and cold? If more than one, which is the least sopensive? If none, which is the nearest a non-conductor? A. There is no metal which is a non-conductor of heat. Among the poorest conductors are plannth and mercury, which have about 1/30 the conducting power of silver.

conductors are binnuth and astreury, which have about 1,50 the conducting power of silver. (12407) N. P. T. saks for formulas for coments for barrols and cashe A. (1) livrwer's consent for conting—The following compounds recommended as a good and change substitute for hewever pitch: Cost twice the lassed of a berrel with a solution of rosin, 4th pound, is heliac, 2 outcow; respection, 2 pounds, atchedo. After the complete drying of the second cost give a last cost by applying a solution of 1 pound shelles in 1 quart of strong slowhol. This varnish will perfectly cover up the press and does not crack off or impart a love present of the press and does not crack off or impart a large present of the press and does not crack off or impart a large present of the press and does not crack off or impart a large present of the press and does not crack of or impart a large present of the press and does not crack off or impart and the press of the press and does not crack at low heat a mixture of large, 30 parts, Apply with beat. (3) Leaking barrols—Melt at a low heat a mixture of large, 30 parts, post asks, safted, 5 parts, post asks, and partifies, of parts. This content of large pressure of large pressure of the pressur

(12408) B. R. T. says: Can you tell

the quantities of ottos, oth	erwise eessutia
to various plants	: A. They are
	We Otto
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Orac 19:	Onnoes
Dry material control 20	
	17/2 ·
Fresh pepperminition 100	" 8 to 4
Dry peopermint	14 Sto 4
Dry origanum	. " 3 to 8
Dry thyme	E 4 1 to 114
Dry calamus The	S. " 8 to 4
Anise seed 25	" 9 to 12
Caraway	" 16
Cloves	214
Cinnamon	
Cassia 25	· '%''
Cedar wood 28	
Mace B	. * p. 8
Nutmegs	" 8 to 4
Fresh balm berb 60	1 256 136
CHES OF DILLER SIMODO TO	
Sweet flag root 118	r et e si
Geranium leaves 142	10 智 (1/6) 養3
Avender flowers	** 50 to 103
Myrtle leaves 122	7 . A. O. A.
Patchouly bers 113	
Provence rose blotten 4.72	· · · · · · · · · · · · · · · · · · ·

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POILLING MACHINES

the gasoline engine might be compared with a possible thirty horse-power of three horses. A horse-power of one hun-dred is sufficient to maintain a speed up to forty miles an hour and to carry the ongine up such hills as those in St. Paul and on upper Lexington Avenue in New York city. The machine can be readily controlled, and the New York Fire De partment is now training fremen spe-cially for this purpose. With chains on the rubber-tired wheels the engine can travel effectively over snow and ice. has a seat for an extra fireman besides the driver; and while having a longer wheel base than the ordinary engine, yet it is considerably shorter when the horses are considered. In the presence of fire officlais and engineers this new machine was thoroughly tested on March 16th, every possible condition of pavement and grade to be encountered being tried as well as the pumping capacity. After ward the engine was put into service at an uptown station where the company is located in a dangerous district and answers some one thousand alarms a year These particular alarms require a prompt response, and the new engine will have every opportunity to prove its advantage The economy is of course obvious, although the transformation of such a fire engine and the addition of the motors costs about \$4,500, making the total expense for the engine \$10,000 or \$11,000. The only expense of maintenance is for fuel and lubricating oil. Inasmuch as the mileage even on a thousand alarm a year basis is very small, the deterioration is not to be compared with that of a com mercial truck or even a touring car, both of which are run for long distances with a considerable aggregate in the course o the year. The annual saving is estimated at about \$2,000 per annum; and in addition to the elimination of the es, space is released for another unit, such as a second engine or extra hose tender, not to mention the fact that the quarters are made pleasanter for the fire-

ered also the new motor hose tenders, of which three of huge size and one single wagon have been delivered. Th mount a turret nossle and carry the heavy hose for the high pressure com panies where the engine is now displaced. Then there is the automobile water tower described at length in a recent issue of the Scientific American. This was shown at the recent test and illus trated how readily such a massive piece of annaratus could be handled, it being stble to turn the long carriage on the rear wheels as a nivot. Though the horse may be miss ed as a picturesque sight in our metropolitan streets, yet the gain in time and power may prevent some threatened configuration.

Pure Science and the Public West (Continued from page &cc.)
This condition gives a powerful fresh

reason for defending pure abstruss aci-Applied science always he is now, and probably always will be disis now, and promote ways was to the tinctly subsidiary to pure science. The final justification of all scientific research is undoubtedly the power it creates for the use of mankind, but the net be created before it can be used. A little study of the history of science should suffice to convince any reasonable mind that the command ees to-day over nature is due to the possess to-day over nature is been to-labors of men who have almost invariably pursued knowledge with a pure de votion uncontaminated by any worship of unsfulness. These devoted idealists have enthered the varied mighty harvests by

which all men have profited, but the debt be kept which all men have profited, but the debt be kept of gratitude to them is unpaid.

The pursuit of abstrass estence needs he accouraged. It is insufficiently of waddle indicates. This doctrine ought to be one with it.

phasised on all suitable occasions, but especially before the section of experi-mental medicine. The people cry for relief from sickness and their demand for apt useful discoveries is so urgent that there is danger in it, since it tempts medical investigators away from the fundamental inquiries, which, answered will give great results, and seduces them to work exclusively at secondary problems, from the solution of which quicker but smaller results may be expected. Pure science is broad; it embraces all. Applied science is a congeries of fragments, of isolated problems, which lack cohesion and are without any neces connection with one another. It is easy to understand why students of applied science have seldom made great discov

"In fact, scientific knowledge will not be compelled. We have to take what knowledge we can get, and by no means can we get atways what knowledge we want. Pure science adapts its undertakings to these sigid conditions, and works where the opportunity is best-not so applied science

"Let us recall a few of the enoch-mak ing discoveries. When Galileo turned his lean face up toward the swinging lamp in the Cathedral of Pisa and as he looked discovered the law of the moving pendulum, he was in quest of pure knowl-edge. We can not ponceive such a man actuated by any lower motive. Even when we learn of his astonishing the Venetian merchants by enabling them to see their far-off vessels through his newly invented telescope, do we not feel that it was merely an episode to Galileo! Such a man does not ask 'What use is it?' His demand for knowledge was insatiable. We have only to read the words of the great pioneers to convince ourselves that they were all in search of knowledge for knowledge's sake. they are the giants of suman history who in importance are approached by few monarchs or statesmen. Compared with the growth of science the shiftings of governments are minor events."

With the motor fire engine are to be Novel Log Skidding and Loading Machine

rd from page 511.)

propelling. It is, of interest to note that the skidding engine is equipped with link motion for reversing so that the machine may be moved in either direction along the track.

One of the most remarkable of warlous types of steam log loading machines in service to-day is shown in the illustration at the right hand side. Its construction is unique for loading operations as it provides for passing the empty cars and trucks through the machine o the very track on which the machine travels. When the machine is in a po sition for passing the cars through to be loaded, the trucks are swung out and upward by the hoisting engine, thus al-lowing the machine to settle down on four curved legs. This arrangement leaves a clear track under the machine through which the cars can be drawn for the purpose of loading.

The curved legs are provided with flexibly connected shoes long enough to cover from three to five ties each, which gives the machine an exceptionally wide and substantial foundation or base. self-propelling steam log loading machine is usually provided with a steel swinging boom but in some instances wood boom

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By Ralph C. Davison

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HIS work should THIS work should appeal strongly to all those interested in ornamental concrete as the author has taken up and explained in detail in a most practical manner the various methods of casting

mental shapes. Full directions are given for making the wire forms or frames, covering the wire frames and modeling the cement mortar into form, selecting and mixing the ingredients, making the different kinds of molds and casting and finishing the various objects. Directions for coloring cement, inlaying, water-proofing, and reinforcing are also included. With the instructions given in this book, any handyman or novice can make many useful and omamental objects for the adornment of the home or garden. The amateur craftsman who has been working in clay will especially appreciate the adaptability of concrete for pottery work.

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A Proposed Ascoplans Race from Rome to London.—In Addition to the cross-country acroplane race airceds proposed from Silvanian Control of the Control of the

methods of castill fight to Indburne, twenty miles northeast of Bordeaux. They covered a concrete into ornations of 10 miles. Lieux Princisus of 10 miles. Lieux

Wactricity

Ing the coming aummer.

Delivering a Message by Accoplance of the Common and the

cording to Major George O Squiet, was arranged to carry a steel sheathed pilot one of the most auccessful that has thus life been made by our army agriators. Flying in Maciso.—Durs' the exhibition flights of the intermidental sylatory to owing to the large amount of water times ctroid Chapultagai, Cardien a spectacular flight from the winted field. Cut by ascending to, a belief of the control of the condition o

dight of over an agreement of the first typically italian, should be yielding to sone on an accopiant. This achievement was credited to Henri Farman twelve months acc. By way of link achievement was credited to Henri Farman twelve months acc. By way of link achievement was credited to Henri Farman twelve months acc. By way of link achievement was credited to Henri Farman twelve months acc. By way of link achievement was credited to Henri Farman twelve months acc. By way of link achievement was credited to Henri Farman twelve months acc. By way of link achievement was credited to Henri Farman twelve months acc. By way of link achievement of link achievement of Electrical Engineers, on chemical control of the machine there being no one of the men was forced to fad a seat on the tail of the machine, there being no one of the men was forced to fad a seat on the tail of the machine, there being no one of the men was forced to fad a seat of the men was forced to fad a seat of the men was forced to fad a seat of the men was forced to fad a seat of the men was forced to fad a seat of the men was forced to fad a seat of the men was forced to fad a seat of the men was forced to fad a seat of the men was forced to laye there and the process of the force of the men was forced to laye there and the process of the force of

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The Morris Canal to Be Abaudoned.—
The Morris Canal to Be Abaudoned.—
The Morris Canal, built between 1828 and 1834, at a cost of five million dollars, which extends from the Delaware Elwer at Philliphoury to the Hudson Water at Jersey City, a distance of 103 Mover at Jersey City, a distance of 103 Mover at Jersey City, a distance of 104 Mover at Jersey City, and Jersey Company, if the consent of the State of New Jersey can be secured. The heaviest traffic, in the year 1866, was 890,000 tons. An interesting phanes, over which the boats, built in two sections, are hauled from one level to sanother.

Basical Transister of the transister of the transister of the satire leagth of the Catakill aqueduct tunnel it has been necessary to go down over one thousand feet below the river surface. Investigation was made by weak borners of the transister of transister of the transister of transister of the t

The Imperiant Government Jetty at San Pedra.—After ten years of constant labor, the government completed a few months ago the huge breakwafer at the harbor of San Pedro, Cal., which extends seaward for a total distance of the second seaward for a total distance of 250 feet, and a mean width of 300 feet at the bottom. At the extreme outer end the depth of water is 45 feet, and here will be erected a permanent light and fog station, which will rest on a solid concrete foundation 40 feet square concrete foundation 40 feet square in the subestructure, and 232,560 tons in the superstructure. The total cost of the rock alone was \$2,745,590. The Important Government Jetty at an Pedro, -After ten years of constant

Alming 1, as from the Conning Tower.

Alming 1, as from the Conning Tower.

According to sable dispatches from Gibraltar, the new battlenby "Neptune" has recently made a test of a new system of aninag the main battery, which make the connection of aninage the main battery, which the connection of the modern system of target fring. It is stated that, while the "Neptune" was steaming at 13 knots, she fired two broaddiese in quick succession at a two broaddiese in quick succession at a tance of \$,000 yards, and that every shot went home. The aiming and fring of the guns is done entirely from the connection of \$,000 yards, and that every shot went home. The duties of the gun crews being more of the duties of the gun crews being more of the duties of the gun crews being more of the duties of the gun crews being more of the fact that the second only in Importance to his famous improvements of five or six years ago.

A "Lengueget Ship "Competition.—To

The "lathered" as New Cruise. —The Government red of the Son Occurs and the Son Diego on February absorbers of the Son Diego on Son Die

Russia supply is the Ursi Mountains in Russia

The Nature of the Aurera.—According to a theory recently nunclated by Prof. Lenard, the aurora better the profession of the Common of Cathode rays, emitted by the Company of the Cathode rays and the Cathode rays must be nearly squal to that of light, and very much greater than the velocity of eathode rays produced in the laboratement's profession of the Cathode rays produced in the laboratement's profession of the Cathode rays produced in the laboratement's profession of the Cathode rays produced in the laboratement's profession of the Cathode rays produced in the laboratement's and cathode rays are emitted by unknown radio-active substances in the sun.

A Society for the Advancement of Science.—The society which was loughed and an endowment for scientific research. At the last meeting about a bunding laboration were present, the challman being the load of the company of the last meeting about a bunding laboration which was considered to carry out the work. The society intends to begin by founding two chemical inatitutes under Profs. Beckmann of Leipzig, and Habor of Kartaruhe. Then a biological Haborate of Kartaruhe. Then a biological statistical of the hundred of animals statistical of the hundred of animals statistical of the hundred of animals statistical of the succession of the succession of the hundred of animals statistical of the succession of the successi

while exceed a permanent light and fog station, which will rest on a solid concrete foundation of one of the restriction of the

hand to handle all the collection adquately.

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sacce of 2,500 yards, and that every such the sums is done entirely from the consing tower, the duties of the gun crows personal property of the consist of the sum of the sum is done and the sum of the sum

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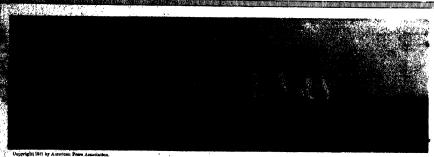
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By ALBERT A. HOPKING, Caltor of the Scientific An

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, APRIL 1, 1911

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SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, APRIL 1, 1911

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The Editor is always glad to receive for examination illustrated articles on adhects of timely interest. If the photographs are shorp, the articles short, and the facts millionic, the contributions will receive special attention. Accepted articles will be paid for at tequiar space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to react this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Why Not Revive Preferential Duties?

N the year 1810, ninety per cent of the com-merce of the United States, and a considerable part of the Onice States, and a considerante part of that of foreign nations, was carried by American ships. Furthermore, American shipping registered for over-sea commerce had grown from 123,000 tons in 1810. Today, not only is our share in the carrying of fore commerce practically nothing, but our merchant marine is declining so fast that the day of its ultimate extinction is in sight; and although our foreign trade has grown to the enormous total of three biltrade ans grown to the chormons wan a state in lion dollars, we are dependent upon foreign ships for its transportation, and are paying the foreign ship owners annually in freight charges, a sum of

out three hundred million dollars.

What was the attitude of the government, which so wisely fostered the shipping industry of the young republic as to cause American deep-sea tonnage to increase eightfold in a little over cades? The explanation cades? The explanation, so far as the attitude of the government is concerned, is very simple. On all freight imported into the United States in American oms, there was a remission of ten per cent of the customs duties.

In view of the prejudice against the payment of ship subsidies (and the history of recent agitation in favor of subsidies seems to indicate that the hostility layor of subsidies seems to indicate that the hostility is nation-wide) there is a growing feeling in Washington that if federal assistance is to be rendered, it must take a form that is less objectionable, we had almost said irritating, to the susceptibilities of the public. Why, then, in view of the great success of preferential duties in the early days of the republic, should they not be revived in this era of great industrial development and expansion of our foreign trade? No one would now ask for a ten per cent reade: No one would now ask for a ten per cent rebate; one of five per cent would be sufficient in these days of high tariff. We commend the question to the consideration of the readers of the Schwarze America, and shall be glad to throw open our correspondence columns for a discussion of the problem.

Our Naval Guns and Pewder

T cannot be denied that in the contest between T cannot be deniced that in the consert necessary against an armor, the most powerful rifed guas for the day have established a considerable lead. Such, at leadt, as the impression which we derive from a perusal of the annual report of Admiral Mason, Chief of the Bureau of Ordanace of our navy. We have an mind the very significant fact that in the recent gun-versus-armor experiments, carried out on the Potomac, the 45-caliber, 12-inch gun casily penetrated at a range of 8.000 yards, the 10-inch curved armor plate which had been creeted upon the obsolete ram "Katahdin." This gun is of the same type as that carried on the "New Hampshire." Simple days lowers a Machine 10 inch. same type as that carried on the New Inampanies. Since her day, however, a 50-caliber, 12-inch gun of prenter power has been developed, which will form the armament of the "Arkansss" and "Wyoming;" furthermore, on the "New York" and the "Texas" will be mounted ten 14-inch, 48-caliber guns of much

greater power even than the 50-caliber, 12-inch. The Bureau of Ordnance is to be congratulated on The Bureau of Ordnance is to be congratulated on the fact that they forcase, serveral yoks upa, the return to gene of saliber larger than 12 incleas, and bullt, accordingly, a type gen of te-insta saliber. This gan has given excellent results in whal strings, and thus the navy is funnished with a well-proved type, ready to be bullt and mounted upon our latest battleships. The introduction of guns of large cali-ber has called for a new design of turret mounting, and a preliminary plan, deaven up in 1908, has been adopted with certain necessary modifications. Although the "Wyoming" and "Arkanasa" were designed with turrets having two-stage ammunition hoists, it has been determined, in view of the very great success with manual ammunition handling and

great success with manual ammunition handling and great success with manual ammunition handling and loading in the 12-inch turrets of the "Louisiana" and "Vermont," to adopt a somewhat similar system for our later ships. The turrets for these will there-

and "Vermont," to adopt a somewhat similar system for our later ships. The turrest for these will therefore have a hand powder supply all the way from the magasines to the guns. A larger number of shells will be stowed in the gun chambers, and in the upper handling rooms below them, the remainder being in the regular shell soon. The gun chambers, however, will be effectually sealed from the handling rooms at all times. During the year, steady progress has been made in removating the ordinance upon the eleven battleships out of commission. No changes of importance have been made in the smokeless powders; the aim of the powder factory has been to suppress the gashity of the pessent output. We are glad to make that these has been a steady increase in the output of this way dislosing actual tractory, a matter which will prove of great impostance in case of hostilities. During last year the factory turned out 1,640,886 pounds were "ne-worked." The present policy is to withdean infector powders and re-work them into a proper condition without waiting for alarming evidence of deterioration. All new ships are being fitted with cooling systems for the magasines.

As usual, the projectile question is causing anxiety the magazines.

As usual, the projectile question is causing anxiety on the score of the limited supply of perfectly satison the score of the limited supply of perfectly satisfactory shells. At the same time, it is gratifying to learn that a new form of projectile (we presume with a longer and sharper conical head) has been with a longer and sharper conical head) has been adopted, which, for a given initial velocity, has a greater range and shows a considerable increase of striking velocity and penetration at long ranges. The advance of armor, on the other hand, has not been entirely satisfactory so far as thick plates are concerned, though there has been a marked improve-ment in the thinner plates. We note that the price ment in the thinner plates. We note that the pace paid for Class A armor, which comprises 90 per cent of the total, was \$480 per ton. The navy should be getting its armor for less than this.

The Private Ownership of American Timberland and Its Menace

TANDING timber is necessarily the source of our future lumber supply. It is but natural that thinking persons view with alarm its concentration, not only in private hands, but in a few private hands. A report prepared by the Bureau of Corporations of the Bepartment of Commesce and Labor and issued in February of this year deals at Labor and issued in February of this year deals at length with the tremendous increase in the value of the standing timber in all parts of the country as well as with the extent to which, in a few years, its ownesship has gradually marrowed. While forty years ago at least three-founts of the timber standing was publisly owned, it is said that now four-afters of it is pavenedly owned. To quote the spect of the property of the spect of the spect

To quote the separt: Engangers of the season and during this interval age: Frame \$5 to \$50 an acre. \$7 to \$40, \$80 to \$150, \$4 to \$15, \$6 to \$146, \$8 to \$50. Specific tracts have been sold first for \$00,000. and later for \$155,000; \$10,000, and later \$154,000; \$240,000, and later \$2,505,000; \$25,000, and later \$500,000; \$19,000, and later \$1,185,000. These examples illustrate the remarkable profit made by

examples illustrate the remarkable profit mage wy certain individual haddern.

"What did the Government got for the timber? Of the senthers pin for state of the senthers pine, sold for \$1.28 an acre, gased is now worth \$60 an acre. Large amounts of Binnylas fir in western Washington and Oreges, which the Government gave away, or sold at \$2.59 an acre, now bring from \$100 to \$200 per acre. The great redwood belt in California was allensted on similar terms. and some of it is now worth hundreds of dollars. terms, and some of it is now worth hundreds of dolterms, and some it is now many an instruction of accu-lars an acre. Practically none of the great forests in the public-land States was sold by the Govern-ment for more than \$2.50 an acre. The great in-crease of, value gives grave importance to the con-centration of ownership."

The report leads us to think that five-elevenths

of the country's privately award stands is in the Earthe-Vestiment (Colliscome Washington, Italy and Montanta,) un-the is now controlled by thirty-seven shelders are closely connected and the the of whom alone own nearly one-for As to the largest holder the

saya:
"The Southern Pacific Company holding greatest in the United States—108 billion for greatest in the United States—108 billion for the univate timber in greatest in the United States—106 Sunoa sec. The is about 8 per cent of the private timber in the avestigation area, and 10 per sent of that in the Pacific-Northwest. It is difficult to give an adequate Pacific-Northwest. It is difficult to give an adequate miles along that railroad between Partiand and Sacramento. The fastest train over this distances in these 31 hours. During all that time the traveling thereon is passing through lands a large proportion of which for 30 miles on each side belongs to the railroad, and in almost the entire strip this corporation is the dominating owner of both timbers and land.

A very significant fact to connection with this common holding is that the Southern Pacific Company is not selling its timber, but is holding this valuable supply, evidently in the comfident hope of a further great sitvance of prior."

Concerning the second and third largest holdings, the Government report has this to say:

the Government report has this to say:
"The holding of the Weyerhaeuser Timber Com-

pany (including its directly owned subsidiary con-cerns) is the second largest in the United States, amounting to 95.7 billion feet. This is only about 18 billion feet less than that of the Sauthern Pacife. Most of this timber—nearly 77 billion feetis in Washington; about 18.7 billion feet is in Oregon, and an insignificant fraction in California. It
is citiefly Douglas fir.
"It should be repeated that this holding, enormous

as it is, includes only the timber directly owned by the Weyerhaeuser Timber Company and its subsi-diary corporations. It does not include further very extensive timber interests of members of the Weyerextensive timber interests of members of the Weyers heaver family and their close associates. This great holding, also, is nearly all being held off the market for the future rise in timber values. . . . The timber holding of the Northern Pacific Railway Company, which ranks third in importance, amounts to 36.3 billion feet. This, it will be seen, is much less than either the Southern Pacific or the Weyer-

less than either the Southern Facine or the wever-heauer holding.

The extraordinary increase in the value of timber land is shown in the following especially striking instances taken directly from the field reports of the agents of the Bureau of Corporations:
"One informant stated that in 1895 a tract of timber land in Virginia was offered him for \$8,500, and he refused to buy it. 'Later' (date not given) the tract was sold for \$48,000, a thirteenfold in-

"In Louisiana, in 1882, a firm bought a tract of 19,000 acres of yellow pine for \$19,000. In

1909 the same tract was sold for \$1,125,000. In 1909 the same tract was sold for \$1,125,000.

"In Michigan a lumberman was offered, but failed to purchase, a section of white pine in 1885 for \$3,200. In 1895 he bought the same piece for \$195 DOD

"In Wisconsin a company owning hemlock, tam-arack, and hardwood timber lands stated that this land could have been bought in 1898 for 50 cents an acre. In 1906 the company was offered \$16 an acre. In 1906 the company was offered \$16 an acre for it, and in 1908 it valued the lands at at least \$30 an acre.

least 830 an acre.

"In Oregon a tract of about 5,500 acres was assembled shortly before 1892 for about \$24,000. In 1800 it was valued above \$1,000,000.

'In Oregon a tract of about 3,000 acres was assembled from the claim holders in 1896 at about 8800 or \$800 per 100-acre claim. The present valuesion is at the rate of \$41,760 per claim, a fifty-faid increase upon the price which the original claim holders received fifteen years ago.
"In Obegon, again, a tract was bought in 1800 for \$80,800, and in 1908 was held at \$45,000."

Apart from the concentration of timber owner-skip outlined above, there is another problem pos-skip of greater impostance, which has been referred to as a "sinker land concentration." After all timber has been cut off, the land may be adapted for timber has been cut off, the land may be adapted for a new growth, this leading to a perpetuity of the standing timber monopoly, while a large purion of the land will be suitable and exceedingly valuable for agricultural purposes. The acres of land this involved run into many millions, and the power fa-volved in such land concentration irrespective of the timber values is difficult to extenset. Especially, is this so with a few of the largest owners occupying dominating patitions as to railroad transportation over large sections of the country.

The second of th

Edouard Branly

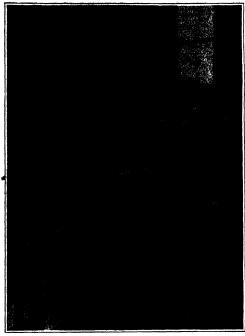
The Successful Rival of Mme. Curie at the Paris Académie des Sciences

By P. F. Mottelay

DOUARD BRANLY, who was a recently elected to fill the Gently vacancy at the French Academic des Sciences by a majority of only two votes over Mme. Curie, was born at Amiens on the 33rd of October, 1944. He made his first studies at the College of St. Quentin, and, after following a course at the College Henri Quatre, in Paris, was admitted at the Ecole Normale Superioure in the last ed city. The completion of his studies had brought him a Fellowshin at the French University and the Segree of Doctor of Physical nce, as well as that of Doctor of Medicine. He then became Professor at the College of Bourges and subsequently was appointed Director of Physical Instruction at the Serbonne, which post he re-tained up to the year 1876, when he commenced a series of lectures in Natural Philosophy at the free

Professor Branly has been indefatigable in his electric researches and has made many very valuable discoverties, as will be seen by referance to the Comptex Rendus of the French Academy of Sciences, as well as to the different scientific publications of the time.

tithe publications of the time. The results of his most important antly investigations are recorded in a volume published in Paris during 1902. Telegraphie at Telegraphie at Telegraphie at the time of t



EDOUARD BRANLY: A PIONEER IN WIRELESS TELEGRAPMY

Paris Academy of Sciences awarded him the Houlevigue prize, and the International Jury of Superior Precept Instruction gave him a grand prize. For his remarkable work done from 1898 to 1800 in wireless investigations the French Minister of Public Instruction made him a Chevalier of the Legion of Honor, and Pope Lee of Commander of St Gregory the Great

During the past twenty years Prof Iraniy has brought forth many improvements to his previous discoverice. He has introduced among other apparatus, new radio-conductors with tempered and polished steel contacts for wire-less telegraphy, new independent distributing contrivances for producing tele mechanical effects without wires, and, some four-years ago, he constructed affects and the property of the property of the property of the property of the problem of methanical effects. He has also done much toward solving the problem of maintaining secrecy of communication between transmitting and receiving stations.

Of late the Professor has awakneed attil greater astonishment by his reported progress in telemechanics proner. He has shown that, without possible interference by electric atmospheric disturbances, he can start and regulate machinery, discharge artillery, operate mines, start the lampa in lighthouses, etc., by wireless, at a great a distance as 150 miles, and that a system of reflected waves will enable him to observe the resulting operations. Some of the explanatory details of this have aiready been disclosed in these columns.

Electrolytic Iron—Can It be Made an Industrial Product?* By Charles F. Burgess

D URING the past five years investigations have been carried on in the chemical engineering laboratories of the University of Wasconsin, deading with electrolytic refining of iron and its use in the production of alloys. About three tons of iron have been refined and over 1,000 alloys produced and tested. While this exporimental work has been on the "dest tube" or laboratory scale, it is believed that some of the results indicate the feasibility of enlargement to commercial state, and a short discussion is submitted here bearing on the question. "Can electrolytic from be made an industrial product?"

Many old textbooks or "Many old textbooks or "Many old textbooks or "Many".

so make an institute product; and the second product of the scriptions of methods of depositing from electrolytically, implying, therefore, that electrolytic from is not a new product. The only use suggested, however, is for facing sagraved pistes used for printing. By following say of these earlier processes it is seen that only were this agent of from can be déposited, the coating tending to become darks rough and powdery. It is to arrive the this limitation that the work at the Darwegit or Wisconsia was undertaken, and that this has been spocessful, in a measure, in teffenced by an iron estables meany a inches in their the second contraction of the contraction of the

THE FIELD FOR BLECTROLYTIC IRON.

The manner in which electrolipic celluing has revlutionized the cupper industry in now as all story, and shortcupen has literated secone as industrial agast in the mealthrap of offers, gold and lead. Now, that if his leves from that they auth is reduced electroliptically almost as easily as coppie, it is perthent to

inquire whother there is a field of usefulness for auch from. This depends upon whether electrolytic iron hes superior qualities due to purity or physical condition, and whether it can be procured at low cost.

From the standpoint of purity it must compete with a some notable metallurgical developments which have not resulted in preduct such as being made by the American Rolling Mill Company in a basel one hearth process. For this material a purity of \$9.94 per cent is claimed, and justifiably so, as some of our analyses as show. The electric turnace is another factor which to it contributing largely to the control of the composition and purity of iron allows, and the striking possibilities which are offered in this developing fold cannot be overlooked in advocating the development of an electrotitic from process.

an attentivitie iron process.

The chief source of commercially pure iron has been and, perhaps, now is, the high grade Swedish and Norway iron, used largely as a base meterial for high grade cracible steel. The analyses of this material usually indicate a high purity, though frequently and orroneously calculated by difference, after determining carbon, sulphur, siliton, phosphorus and manganese. It is not uncommon to find otides and siag to the extent of 2 per cent in this material, and this impurity undoutstefly may have an influence on the resulting alloys made from it.

ELECTROLITIC IRON 99.97 PER CENT PURE.

We have found that electrolytic iron can be produced with a purity as high as 937 per rest. portugar, seen Seiter, using extraordinary production. This record has been made by using the best commercial gradus of price two as smoker. A few hundredths of I per cent of purity must be secrified in using anodes of mild skeel or other less give materials. Electrolytic refining offers a means of reducing or someoning out most of the impurities commonly found

in iron and of producing a material not only of high purity, but of great uniformity. Even though it may be shown eventually that electrolytic iron may not have a higher purity than that attainable by other methods, the uniformity of its composition should make it a valuable material as a means of climinating many of the variables with which the crucible steel maker has to contend.

Using an electrolyte containing 40 grammes of from per liter in the form of ferrous sulphate, together with 40 grammes of ammontum chlorids, it has been found possible to conduct a continuous refining operation for many months at a current density of 6 to 10 amperes per square foot of cathode surface, and at a potential difference of about 1 voit The current efficiency is very close to 100 per cent, as it is in copper redning.

A CALCULATION OF COST.

This leads to the calculation that 1 kilowath hour will refine 2 pounds of iron; or a cost for power of ½ cent per pound is attainable. The costs for labor, solution maintenance and fixed charges are estimated to be not greater than the power costs, making a cest of refining of about 320 per ton. Assuming the anode material to be a mild steel cesting 335 per ton, the cost of electrolytel iron would be in the neighborhood of \$55. These approximate calculations indicate that this material might well compete in price with high grade Swedish tron.

Among the properties of electrolytic tron which may give it some adde usefulness is its contents of hydrogen and the brittleness which results from this occluded gas. This hydrogen may be of some service in reducing oxides in a melt. The brittleness of the electrolytic fron before the hydrogen is driven off makes it easy to break it up into pieces suitable for introduction into the steel crucibles.

Aviation Exploits at Home and Abroad

Foulois on the Mexican Border: the Flight to the Puy de Dome

The Wright Army Biplane

OivE of our illustrations shows the Wright biplane which was recently loaned to the army by Mr. Robert F. Collier, in flight above the camp at San Antonio, Lieut B D. Foulois and Aviator Philip l'armalee have made some excellent scouting flights in Texas recently with this machine when they flew from Laredo to Eagle Pass. an air line distance of 104 ½ miles, in 2 hours and 7 minutes. By following the Rio Grando they covered about 106 miles actual distance, their average speed being close to 50 miles an hour. On the return trip the machine met with an accident and landed in the river. It was transported back to camp, and, after repairs had been made, some more excellent scouting fights were accomplished. On March 18th they flew for several minutes in the pouring rain, thus demonstrating that the aeroplane could be tremely adverse conditions. The Signal Corps acquired last week its first Curtiss biplane, and this has been taken to Texas use at the maneuvers. The original Wright bip'ane which belonged to the Sig nal Corps has been returned to the factory for remodeling. It is probable that in addition to this the army will have several more Wright and Curtiss machines for use

The Winning of the Michelin Grand Prix

On the need of the aviation world of a grand prize for a supendous feat, the Michellin brothers—France's great tire manufacturors—based their \$20,000 prize three years ago. The great flight they proposed was one of 222 miles from Paris to the Pay do Dome mountain, a 4,813 font peak locate de near their works at Clermont-Ferrand The aviator munt carry a passenger and make the flight within the elapsed time of six hours, circling the Are do Triomphe at Paris at the start and turning about the steeples of the cathedral at Clermont-Ferrand before the flight. As the summit of the mountain afforded a very constricted landing place, it was generally supposed that an aviator ratemuting to land upon it would demolish his machine and perhaps be killed or seriously injured; and consequently, a month or two ago, the Michelina attempted to moutfy the rules to read that a safe landing must be made without breakage of the machine—This modification was not allowed, but Romanz fulfillied it never

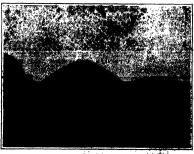
At the time the Michelin prize was offered, the best records abroad were for height, 12 meters (39 4 feet), made by Blériot in August, 1907, and for distance and duration 2,004 meters (6,575 feet) and 3 minutes and 39 seconds respectively



MM. Renaux and Senouque starting on their 235-mile flight from Paris to the Puy de Doma.



The biplane gliding to the summit of the mountain,



The biplane approaching the Puy de Depot

The observatory can be plainly seen on top of this 4.815 foot mountain.

(made on March 21st, 1885—two frauts after the trophy was offered—by Henry Sairmes). As for carrying a passenger, this had been go been done, even by the Wights in Absorbed best improvable did, it seem is the theories that the feat their prise called for could be accomplished, that they allowed a people of ten years is which it could be Wigh.

The marked advance in availation in 1849 shall be represented and more varied recognism. As the control of the

The first of last month Veryman, with his Rinity Farman biplane, and Resaux, with a signific Massiver Farman machine, began specifising making long gitting from heights for 1,000 feet or so, small slighting upon a signific marked off upot. Next they perfected theirselves in slighting upon such a spatial with a nessential.

the passage of the pa owever, word was received that the sir illies, with no wind. As there was only light, and favorable northeast bree ing at the serodrome at Buc, Renaux ge out his machine, and climbed aboard with his passenger, M. Benouque. He left the ground after a short run at 8:50 A. M., and w to the Aero Club park at St. where he crossed the starting line at 9:12:84 2/5. Heading straight southward, he flew above the serodrome of Juvisy at 9:28. Fifty minutes later he passed over the railway station at Montarris, and flow down the line at an elevation of 1,000 feet, over-taking and heating an express train. In ansed Coune at high sp and at 11:30 La Charitle at a height of 000 feet. A quarter of an hour later the ma-chine was sighted by the great crowd that awaited it at Nevers, where Rena planned to slight and take on fuel ere Renaux had St. Cyr, the avistor alighted upon the arrodrome of the "Lone Poplar" at 11:53:30.
His time for this first stage of the journey (141.5 miles) was 2 hours, 40 minutes, 55 3/5 seconds, and his average speed about 53 5, miles an hour. He reported heavy wind guess mear Bulars, but the favorable (Ondrewed on page 50.)



Aviator Philip Parmaloc and Licut. B. D. Foulois Sying shove the army encamples of the Adjunct Record Report of the State of the State

Two Recent European Compound Locomotives

A French and a Hungarian Engine

By our London Correspondent

TOR remains which, even to-day, are not altogether a charge. European locometive builders regard the compound type of locomotive with much more favor tipes we do in the United States. The trial of the spatem in this country has shown it to be not we adapted for local conditions. In Europe, it appears to meet conditions in a very satisfactory way—at the man, this is the conviction which is ferced upon us by the very extended use of the system on the Continuent, Way present brewith photographs of two of the latest European productions, one a French four-cylinder compound express locomotive, the other a four-cylinder compound register locomotive, built for service in Hungary.

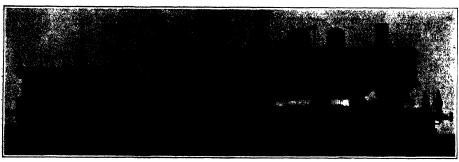
on coupled wheels is 48 tons, while that on the trailing wheels is 11 tons. It is of interest to note that the mean diameter of the boiler is 63 inches, and its working pressure is 213 pounds per square inch. The working pressure is 213 pounds per square inch. The bolier has 25 tubes 2.5/2.7.76 inches and 24 tubes 4.59 inches in diameter. The heating surface in the frebox is 1271 square feet, and that of the small tubes is 1,55.5.5 square feet, while the heating surface of the large tubes is 144.5 square feet. This gives a total of 2,155.1 square feet. The area of the super-heater is 414.4 square feet, and the grate area is 34.7 square. feet.

The high-pressure cylinders have a diameter of 15 inches and the low-pressure cylinders are 23 6 inches

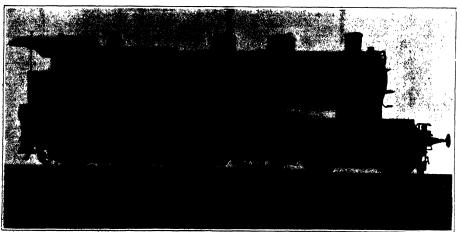
The compound Hungarian locomotive is not, as at first sight might appear to be the case, of the Mailet type. It employs two sets of driving wheels and two independent sets of cylinders, but each set is attached rigidly to a common frame.

One set is operated by a pair of high-pressure cylinders and the other by a pair of low pressure cylinders.
The engine was designed for drawing heavy loads up grades of a maximum of 25 per cent, and operating on curves of a moderate radius

The two high-pressure cylinders measure 164 inches in diameter and the low-pressure cylinders 251 inches, the stroke in each case being 25.6 inches. The eight driving wheels are 4.72 feet in diameter, and



agh this engine looks like a Mallet it is not artemisted. Two distinct cets of engines and driving where are catted on a single frame. High-pressure cylinders, in 4 inches by 25.6 inches; low-pressure cylinders. St. inches. Weigh, 71 mass. Healing surface, 2,257 is aquate feet



Weight, 65 your besting surface, 2,155 square feet; high-imposure couldons, 15 inches by \$5.6 inches; low-pressure cylinders, \$5.8 inches by \$6.6 inches.

A powerful Pacific type French passenger engine with superheater.

TWO PRODUCTS OF EUROPEAN LOCOMOTIVE SHOPS

French engine, a well-proportioned design, on twolve wheels, was built for the rali-of Alsaco-Lorraine, by the Societé Alsaof Aisson-Jervaire, by the Bootete Aisson-day Constructions Machaniques, it is pro-tit a Schattit smeke table superheater. Ordi-day waters are used for the low-gressure cytin-it Schattit's piston valves for the high-pressure of . Two independent Walefapert sures at the total weight of the singless sample is 25 to the total weight in working order is \$2 ton-ledge, of the track is \$2 tons, and the weight

AND PARTIES.

in diameter; the piston stroke is 23 6 inches. The coupled wheels have a diameter of 80.38 inches, and the bogic wheels have 37.48 inches, while the trailing wheels have a diameter of 55.16 inches. The total wheel base 65 the engine is 33.958 feet, and its total

wheel base 8c the engine is 33,585 feet, and its total length is 4.586 feet.

The tender empty weighs 31 tons, and the water capacity of the tender is 21 tons, while the coal capacity is 6 tons. This gives a weight of 48 tons in working order for the tender. The diameter of the lender wheels is 3,581 feet.

the total draw-bar pull is 12.7 tons. The total length of the engine proper over all is 39 34 feet. It weighs empty 64 tons, and complete with fuel and water ready operation its weight is 71 tons

The boiler has a total heating surface of 2.537.4 square feet, of which 1462 square feet represents the heating surface of the firebox and 2.391.4 square feet that of the tubes, of which there are 272, with an outside diameter of 276 inches The grate area is 86.259 feet, and the boiler supplies steam to the highpressure cylinder at 225 pounds to the square inch.

Notes on the Planets, Asteroids, and Occultations of April, 1911 By Rev. Ruel W. Roberts

Hardly anyone would experience any dimonity in inding the bright and attractive planer. Subject, Saluri and Venus. When visible that crival all the surrounding stars bright and attractive at time of opposition, and always visible to the naked eve, even when more distantly located from the earth Even Mercury can be found without difficulty by merely a naked-eve view if one looks for it at the proper time. This is easily determined by consulting the Noutical Aimonac, and noting when the planet is at its greatest the second of the

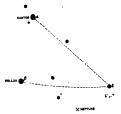


Fig. 1.—Showing location of δ Geminorum

esstern or western elongation, that is, most distantly situated from the sun in either the evening or morning sky as the case may be. The astronomical notes in the SCENTIFIC AMERICAN tell this interesting news from month to month, and for the majority will be more convenient and communicative than the technical and abstract Nausteol Aimonac.

This leves Uranus and Neptune Uranus is not a

This leaves Uranus and Neptune Uranus is not a difficult object of observation at all, and anyone should be able to pick it up with the aid of only an ordinary pair of opera or field glasses or a small telescope. At times it is fairly manifest to the naked eye if one knows right where to look for it. It is of about the sixth magnitude. Early in December last it was close to f Sagitizarii, but not well positioned for observation. From February 1st to April 1st, 1811, it will be from two and three-quarters to five degrees and a half to the left of Sagitizarii. Hardly any further suggestions need be given other than that one should study carefully the principal stars of the constellation Sagittarius, and work out from the more easily detected ones near, to the desired star f, and from it to Uranus.

rrom it to Uranus with a niga power on even a 34-inch orfactor, I have seen Uranus as a disk. But the case is somewhat different with Neptuna To find this planet is a somewhat more difficult task, although within the reach of almost anyone if a little help is given. Yet it is strange that so few amateurs have ever picked it up. Even many college professors teaching astronomy have never seen it. Not long ago a college professor in the West, and a really capable one, to toll an amateur that he could not expert to find Neptune, as he had never seen it.

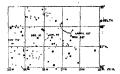


Fig. 2. -x = position of Neptune for given date. D show stars down to the 10th magnitude.

himself, though he had a fine six-inch refractor well equipped in a small observatory. He said it was beyond the power of a six-inch. The truth is that at times it can be seen in even a good pair of field or opera glasses. Quite often one reads in some scientific paper or astronomical journal some such sentences as these in giving notes on the planets. "Non-tune is beyond the range of all save a good-sized telescope and the aid of an observatory equipment." Weptime is invisible except in large telescopes." Yet despite this it is an object of about the eighth magnitude, and at times even between the seventh and eighth, and visible in a small two or three inch instrument.

Now 1611 is a very favorable time to look for Neptune, because it is in close proximity to Delta Geminorum Neptune was practically stationary from October 1st to December 1st. During all this period its entire motion was only about eas minute of time --fites minutes of arc. On October 55th it was entirely stationary, at this time it was a little over four degrees from Delta Geminorum. It then began to move toward this star, although only slowly at first in Fig. 8 its position is noted for Novembers sit and four subsequent dates. On March 36th it was again stationary and at its mearest point to Delta Geminorum. So this is the most favorable time for its study. From this time on it moves away from the Delta, and continues to separate itself from that star until November 1st, 1911, when it is again stationary, it resumes its motion again toward Delta until April 1st, 1912, but is not nearly as close as for this year of 1911, and it will not be close to any star visible to the naked eye before November and December, 1912, when it will be very close to SS Geminorum.

With the sid of the star map in Fig. 3 one can locate it for any of the dates given, or for the intermediate dates by making a due allowance. With the sid of a pair of opera glasses one should study carefully the stars in the Stid designated. About two degrees to the left of Delais is an interesting group of quite bright stars which form an interesting circular shape. In the figure they are connected by lines to show their shape. In a straight line from Delta and through this group one comes to two small stars, fairly bright and close together. They are shout one degree from the star group. Working out from this configuration, and delly studying the signs, carefully familiarite yourself with the stars man. Mystuss. Nepture will manifest the stars have Mystuss. No can be succeeded as the star in the

This same method employed in finding Neptune esabled me to find Halley's comet in a 3½-inch refractor a year ago last November, and may also be employed in finding faint telescopic comets, asteroids, and similar objects, though one has but a small instrument at his disposal.

"There are," any Astronomer Noble, "few more curious, Insurective, may, even startling sights in the heavens than the occultation of a fixed star, or more rarely of a planet, by the moon. When this occurs at the dark limb of our satellite, its suddenness is such as not infrequently to extort an exclamation from the observer who witnesses it for the first time.

"In a moment in the twinking of an eye," the

star which shome as a brilliant point in the say is biotied out, and its place seemingly knows it me more until it reappears from behind the opposite or course, the easiern limb is illuminated, so that the disappearance takes place at the bright class, sed the star on its respectance starts instantly from behind the dark limb. Such a fractinating sight sheeds be witnessed by averyone, and so below we furnish the list of occultations for the month of April, so that one can see when to be on the outlook for the placement. The magnitudes are given, so that one can see when to be on the outlook for the placement. The magnitudes are given, so that one can see when to be on the outlook for the placement. The magnitudes are given, so that one can see she digitates. One should have no difficulty in seeing the same a small telescope or part of opers or Seddigissess. One should have no difficulty in seeing the part of opers. Any such occultation may be witnessed in a two-inch instrument. The nearer to new morn the time, the finer will be the start, as the light from the moon is less intense, and so does not dim the star no approachably.

STARS OCCULTED BY THE MOON.

Of the stars occuited by the moon during April, the five following are the more favorable for observing the beautiful phenomenon described above. The time is given in Washington mean time.

D	ste. Name of Star.	Magnitude.		Неарри Жін.		200.		ppessance. Min.	
April	3rd k Tauri	5.6	10	17	P.		10	57 P. M	
	6th Omega Cancri	6.0 -		19				84 P. 4	
	12th Theta Virginis	4.6		57 11				12 P. N	
	16th	4.9						5 A. N	
ADTII	17th 22 Scorpii	, 440			-				

ASTEROIDS FOR APRIL

Below will be found the ephemeria for Cerea, Juné, and Vesta—the only asteroids an amateur sury expect to locate during April. It will be best for the average amateur to center his attention on June and Vesta because of their favorable location, and greating to eastly detacted stars. Cerea to of good small.

nitude though, and may be lighted up by some the canebully studying its lootside on a star man, it is not, however, very close to any estamplousons star. Let be assenting mode, though the the carefully mode, though, that on April 18th June is very close to Delta Virgivis--bis R. A. of this star belaz 12th. Enten, and its zhee, its north 8 deg. 62 min.; In other words, within an animal tea Des. in north 8 deg. 85 min.; In other words, within six minutes of a degree of Delta Virginia and its Des. in north 8 deg. 85 min.; In other words, within six minutes of a degree of Delta Virginia and to the nexth of it. It is not othan so throwthis a, position is presented. Again, by consulting the ephenometric given below it will be need that an almost as faverable position of Vesta presents itself late except your work. The present is self-lated to the nexth of the position of Vesta presents itself late except your work. It will then be near Espation Tauri, whose R. A. is 4h. 38min. and its Dea. north 18 deg. 58 min. By interpolation of the R. A of Espation Tauri on May 1st or 3nd as stated will be 4h 38min. and north Dec. 19 deg. 13 min., or about 14min. or are north of this star. Its magnitude is also faverable.

	CIRI	REG.	
Date,	Mag	R. A.	Dec. Min.
April 6th	8.98	2 45.8	N. 11 55
April 16th	,	2 58.0	18 6
April 22nd		8 10.5	14 14
April 80th	8.97	3 28.8	15 19
	JU	No.	
Date,	Mag.	Hr. Min.	Dec. Min.
April 6th	9.50	18 8.0	N. 1 28
April 16th		13 1.8	2 29
April 22nd		12 55.9	3 32
April 28th		12 51.6	8 58
April 80th	9.65	12 50.7	4 6
	VK	4TA	
Date.	Mag	R. A. Hr. Win.	Dec. Dec. Min.
April 6th	8.58	3 40.5	N. 18 80
April 14th		3 53.5	17 38
April 33nd		4 6.9	18 16
April 80th		4 20.6	19 \$
May 8th	8.68	4 84.6	19 45

The Current Supplement

The plendid article by J. V. Davies on "Manda" Aims Passengers on a Rapid Transit Ratiroad." which was beginn in last week's Surenanzer, is concluded in the current Surenanzer, No. 1839.—From the earliest days of photographic astronomy, one of the difficulties to be met and overcome has been the currature of the field. To correct this, curved photographic plates have been proposed. How they are to be used, Mr. F. A. Bellamy explains clearly—In view of the potable contriversy in which this country and Germany are involved, Mr. W. C. Phalen's authoritative discussion of the subject will be welcomed.—The cranse collection of the New York Zeological Park is described and illustrated.—Mr. F. W. Hankel outlines some new theories of the evolution of stellar systems.—A turning point in the his convertee. Another turning point has been marked by the introduction of electric furnances. The whole subject is well handled in an article entitled "The Wes of Electricity in the Metallurgy of Iron."—Lieut. Plenak P. Lahm ably discusses the relative merits of editable balloon and servious in warfare.

Sugar from Cellulose

possibility of obtaining augar and alcohol cossed and several more or less successful asperiments in this line have been made. Two German decembers, Oct and Wilkening, have recently described the best conditions for the transformation of celled like loss into giveness by subjunctin hydrolysis. This calling house should be dissolved in 75 per cent supparting at the ordinary temperature, in the proportion of part by weight of celluloses to 10 parts of saids addition is them diluted with water until the proportion of the proportion

finally neutralized with calcium carbonate. The solution of glucose thus prepared can either be constructed for the purpose of delatings easier, or subjected to fermantation for the production of sicolation channet the theorytical quantity of glucoses is obtained, while fermantation produces 32 per cent of the lineratinal amount of sicolate.

What do You Think of the Scientific American?

Some Answers to a Question which We Put to Our Readers a Few Weeks Ago

THE full-page advertisement which we published, in Unbick we invited our readers to appress themselves from the SCHETTURE AMERICAN, had brought forth an over-themselve response. Home of the letters have been highly subjected, some have indicated the very present ofers of their writers; and except the continue of the second of the letters of the letters

A Believer in the New Scientific American

A Bellower IN tae New Scientific American
To the Editor of the Scientific American
To the term of the Scientific American
To twenty-six years that it has been coming into
our home, and it is prised above all others to such an
extent that we have every number, well preserved, for
this period of time.
Transfer the weekly list of patents granted to the
forestances, and give us in the grid of the transfer of the
control of the second of the second of the second of the
control of the second of the second of the second of the
control of the second of the second of the second of the
cut out, especially Notes and Queries and Correspondcont.

Shickshinny, Pa.

A. W. STACK HOUSE.

The Approval of an Electrician

The Approval of an Electrician

10 the Editor of the Schwitze American

11 think, after considering the tasks involved, you cover
the sciences and arts in a remarkable way, but would like
to see a series of articles started on elementary astrononey and chemistry. We fellows who shave developed
only is our own particular receasion, have only a smattering idea of what our brothers are accomplishing, and
can hardly realise or appreciate their achievements, because we lack the basic principles, and do not have the
table of the started on the started on the can

the modern text-books. I do not believe such articles
would have to be explanatory to any great degree, but
simple articles that are to the point.

The innovation you made at the first of the year I
think was for the better. Your papers are most interesting and instructive, and I never fail to stop in at the
newstand every Saturday non for the papers that have
precedence over the Sunday newspaper with its accompnaying treats.

The weekly ist of patents does not interest me to any
great degree, and transferring them to the Surramany
makes no difference on the continued.

The naval articles I believe could be less frequent, and
their space taken up by steam engineering and gas engines.

York, Fe. J. laying Thousan Ricettical Specialist.

York, Pa. J. Invine Thomas, Ricctrical Specialist.

An Inventor Speaks.

To the Editor of the Sensympe Americans; I don't like the idea of your trainferring the weekly like of patents granted, to the columns of the Sensympe American Software, for it interests me very much to see the new inventions every week. I like the Home Laboratory pages, for they have some very interesting articles in them. The Inventor's Department is also very

ticles in them. The Inventor's Department is also very interesting to me.

I think if you could give us a page in every issue of schrickly in different forms, and take up the subject of viricless telegraphy and telephone, that it would be greatly appreciated by the majority of your readers. The seronautic progress does not interest me very much, for there seem to be too many lives lost.

Your monthly astronomical page does not interest me, while there may be a lot of your readers that it interests more than any other page. I would like you to add a page for great inventors that have made a success in life, showing the difficulties that they met and how they got around them, and the best way they found to handle their patents. I am interested in inventions more than in anything siles.

J. I. Јонивом.

A Cure for Weariness

To the Editor of the Senerarrac American:
Please do not omit the list of patents issued, as that feature is very interesting; and to the man who is not able to subserible for both the Segurary American and the Suppramann, the former comes very near filling all

the SUPPLANEARY, the former comes very near filling all requirements.

In its new dress I think the SCHETTER ANTRICAN one of the handsomest periodicals published, and If you could know just how worn out I deel on Saturday nights, and how highey I am after supper to read it, and could realize how like wine it is to me. My write easy if I retire without reading out Schendary high it is to me. My write easy if I retire without reading out Schendary hights, I jump and jerk like one with St. Viger dance—that is not recking the bady to sleep, but it states a fact as to me.

The major data I account you get the writing the bady to sleep, but it states a fact as to me.

The major data I considerable use it to good advantage as a considerableance with some of my elected friends; as it is states as fact as to me.

The major data is the considerable of the major determines the department of major determines the department of the states. I made Ill X-Reseal, the attempt of the Compressionship includes been a copy

make the Scientific American an even more popular weekly than it was before. The following latters are selected and published largely for the purpose of stimulating more replies.

The Billier country you to take the same personal interest in the Scientific American that he takes in it makes it, after ead, it is your paper as much as the. You

containing the article on the use of white phosphorus, for which enlightenment be thanked me. He found one corporation had a soul!

Birmidgham, Ala.

E. Z. Caow.

One Who Approves

To the Editor of the Scientific American.

I have taken and read your paper since 1867, and attribute a good share of my success to the very instructive articles contained in its columns.

The Surpassers seems to me to be the home of the weekly list of patents granted. In fact, I cannot suggest how you could improve your paper. You are all right how.

EN Durage Country of the Scientific American Scienti

More Archaeology Wanted To the Editor of the SORMADIC AMBRICAN:
I have been a constant subscriber and reader for the light or thirty-nine years, am not sure which. I so the sufficient answer? I take four other scientific jour of them, the other four wife.

If I have to give a may be seen.

I am gle monthly magazine feature; and I am specially pleased with the new department you have added—
Science in the Current Periodical. "That gives a varney from other authors. The articles in the last two issues under that department about "New Stars," "Origin of Nebules," and "The Universe a Mechanism," were intensely interesting and instructive. I do not read everything in the paper. I never read the Lat of Patents. But I do not wish to suggest leaving out anything, for fear it may be the very thing that interests some other reader. My "hobbid" are astronomy, geology, and evolution. You cannot give me too much about astronomy.

and evolution. You cannot give me too much about astronomy.

If convenient, let us know more about archeology—tell us the news from the explorers in Egypt and Babylonia; what new things they are discovering.

I like the Seinere, Engineering, and Electricity columns, and be sure to keep up the Notes and Queries, which have always interested ine.

Coldwater, Mich.

C. W. Bennery.

A Smile and a Frown To the Editor of the SCIENTIFIC AMERICAN

To the Editor of the Scientific Assignant in the Scientifi

mendable, and I assure you are very much appreciated by your readers.

As to transferring the weekly lists from the Schenytze America's to the Supplement, I miss them hadly, yet must confess that I rarely ever read them. The usefulness to me was to watch for something to come out that would be to my interest.

If I have any objections to the Schenytze American, they are that in giving measurements they are often given in French, and while I may be very much interested in the article, possibly the most important part of It, I do A to the deflorable. I can furly say that the most must be the most many that the processing the same processing

As to the editorials, I can truly say that the most mus-As to the contornat, I can truly say that the most masterful, despit thought out, comprehensive worded articles that I ever read are to be found on the editorial pages of the Scientific American.

Brownwood, Tex.

P. L. HOWLETT.

What a Brother Editor Thinks

To the Editor of the SCIENTIFIC AMERICAN:
It makes a man sit up to see an idea flashed around the world, the execution of which be has been revolving in his own mind. I refer to page 269 of your issue of March 11tb.

Ilth.

I had been considering identically this same idea, as applied to our January and February issues. That is, summarising our editorial features during those two months to show people just what we were doing in the way of instructive and useful information to the trade we

represent.

I compliment the Someword American on the apparent improvement. Although I am not directly interested in a business way in medianics and engineering, nevertheless.

pay for it, and you have a right to tell him whether or not you are getting what you expect out of its pages. If you have not already communicated with the Editor. do so. Tall him whether or not you agree with the read-er whose letter appear on this pay; tell him, but what the SCENTING AMERICAN means to you, where it helps you, and where it failt to help you.

the clear presentation and the able and interesting treat-ment of mechanical devices and scientific improvements have been such that for twenty-three years I have occasion-ally lought a copy and read it carefully, merely in the way of adding to my general knowledge of the practical things that were developing in this greatest of inventive and namefacturing andions as well as abroad.

that were developing in this greatest of inventive and manufacturing nations as well as abroad.

Here is a point that you may consider worth publishing or referring to in some way: For a longer period than the one above mentioned. I have always felt a sympathetic appreciation of a device which facilitated any operation, form a proper twas introduced to a handy, compact, ingenious, or useful device for facilitating any operation, from apple paring to dredging machines, or proper than the properties of the properties of the properties of the properties. The properties of the properti

Abstract ideas do not force themselves in this world. Principles are intrinsically intert. It takes force and energy and driving power to get them adopted. Supplying this need I presume is one of the functions of the Neutrino America. It certainly is a most important function; for the lineator of a useful article, it is presumed, is not working solely for posterity; he wants some return for his invention before he and the patent both expire.

Warra C. Tarros.
Bloston, Mass. Editor of Bost ond Show Recorder.

From a Canadian Reader

From a Canadian Reader
To the Editor of the Susservey Aussucave.
The Handy Man's Workshop is better once a month
than twice The transferring of the patent list to the
Suprement was a good more, as the literature supplied
in its place is of more value. Now autnome, electricity,
chemistry, and physics interest me most. The first two
have received a fair proportion, but I think that chemistry and physics have been slighted, chemistry especially.
Aeromatics have been much to the force, should solo out of
John Collinson. Now that the first great interest is over,
Thanking you for this opportunity, and whiling you
continued success,
W. Kennen. Man.

The Opinion of a Woman

The Opinion of a Woman

To the Editor of the Scientfield Augment of the Color of the Scientfield Augment of the Color of t

companions.

Surely there is no part of the paper that we want to Surely there is no part of the paper that we want to mis, although my untrained woman's bram can only ad-mire, and wonder sometimes, without quit understanding the different values, hippen, and coils in their several offices. Those I pass over, content that there are wise-heads than mine, and that the huge machines will cer-tainly do the work assigned to them. In the content of the above provide although almost cavious, when there are found any who have thought out better ways of doing things.

Chromic Control of the Control of th

Science in the Current Periodicals and Books

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

The Sea Kings of Crete*

PROMINENT among the difficulties which have in the past attended investigations of the earlier Grecular records has been that of accurately defining the point where legend ceases, and where authentic history begins in dealing with this subject it has been necessary to take into account the influence excited upon the earlier historians by the stories which they had been accustomed to treat with reverent aborecitation.

With the development of modern intellectual proposiress, their difficulty became more apparent, until Istance ress, their difficulty became more apparent, until Istance solution was facilitated by the mute evidences of patatic agree. This idea guided the stape of Schliemann and other Heilenic explorers, who would not believe that the monuments of ancient civilization had vanished exfrom existence, but claimed that they could be disinterred. The success of Schliemann's work at Troy gave the needed impetus to the labor of his colleagues as in other fields, who may justle by regarded as having been guided by his spirit in their concurrent and subsequent explorations.

In the assumption that ancient culture was more or less generally diffused, explorers in other Hellenic fields displayed harked activity. In this connection special interest attaches to the researches carried out in the island of Crete, where the arts of civilisation had at an early date attained a high stage of

What Schuchardt did to record Schliemann's work at Troy has been successfully accomplished with regard to Crete in the interesting work before us.

This volume.* replate with available material, defines in lucid terms the connection between the old traditional legends and the discoveries brought to light by recent excavations. By the author's graphic and minute descriptions the palaces and other surroundings of the surroundings are vividly reproduced; while the manner in which the "finds" of antique pottery, metal work and other forms of decorms of decorms of corns of decorms of corns of decorms of deco

ative art have been described, imparts reality and distinctiveness to the narrative of Crete's ancient civilisation.

In a work of this kind close acquaintance with existing authorities on the subject is a primary requirement, and in this respect the author has proved himself an accurate investigator presenting divergent opinious under their various aspects in a thoroughly impartial manner.

THE LEGENDS

The resurrection of the prehistoric age of Greece disclosure of the astonishing standard of civilization which had been attained on the main-land and in the isles of the Aegean at a period at least 2,000 years earlier than that at which Gree history, as hitherto understood, begins, may be reckoned as among the most interesting results of mod-ern research into the relics of the life of past ages. The present generation has witnessed remarkable dises in Mesopotamia and in Egypt, but neither Nippur nor Abydos disclosed a world so entirely nev unexpected as that which has been revealed by the work of Schliemann and his successors at Troy, Mycense, and Tiryns, and by that of Evans and the other explorers—Italian, British, and American—in Crete. The Mesopotamian and Egyptian discoveries traced back a little farther streams which had aldy been followed far up their course, those of ready been followed far up their course, those of Schliemann and Evans revealed the reality of one which, so to speak, had hitherto been believed to flow only through the dreamland of legend. But the legends were manifestly largely imaginative, and it sedued impossible that we should ever get back to the solid ground, if solid ground had ever existed,

on which these ancient stories first rested. What proportion of fact, if any, lay in the stories of Minos, the great law giver, and his war feet, and his Labritath, with its monatrons occupant; of Theseus and Ariadne and the Minotaur, of Daddalus, the first aeronaut, and his wonderful works of art and seience; or of any other of the thousand and one beautiful or tragic romances of ancient Helias—to attempt to determine this lay utterly beyond the sphere of the serious histories.

Within the last forty years all this has been changed. All preconceived ideas may be upset by the results of a single season's pade work on some sincient site. The work, of course, is by no means complete; but already the dark guilf of time that lay behind the Dorian conquest is beginning to yield up the unquestionable evidences of a great and splended and almost incredibly ancient civilization. In this remarkable resurrection of the past the most important and convincing part has been played by the evidence from Crete: but it was not until the treasures of Knossos and Phesicia began to be revealed in 1800 Knossos and Phesica began to be revealed in 1800 Knossos and Flueston was only the decadence of a far richer and fuller culture, whose fountain-head and, whose chief sphere of development had been in Crete.

The first task, therefore, is to gather together the main features of what the ancient legends of Greece

tion which is described in the posses. We use emfronted with a society not by any means in a primitive stage of development, but, on the contarty, for selvanced in the professions of peace and capable-of the highest achievements in art and architecture. SCHLIEMANN AND HIS WORK.

The man whose labors were to give a new impotes to the study of Greek origina, and to be the beginning of the reveition of an unknown world of anolent days, was here on January 6th, 1885, at New Bookson, McKellaburg 46th, 1885, and the study of the treatment of the transport of

were the result of year, laborious meagarithm, and created an extreordinary amount of interest. It was felt that he had hopepht the world face to fisity sight facts (which would profoundly insults) as of the interest had as to the original of Greak dys-

imeten. Sedore the end of the ninescenta century it. became apparent that Carete was destined to people a peem of this early cutture, and the promise has being there than fulfilled.

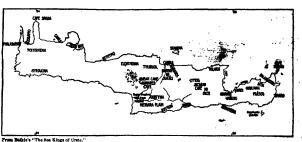
THE PALACE OF BROAD KNOSSOS."

In the revival of interest in the origins of Greek dividention it was reinti-

feet that Crees could not long be left out of inscenses, for the traditions of himos and his laws, and of the wonderful wonds of Duddies ported clearly in this him this first press part, he creek that the real island arms; have seen, he creek that the real island arms; have seen, he creek that of learning and at. Host, of these traditions shutched rained Knossos, the famous capital of Minos, where made at the Labyrinth, and seer to which was Menny Jukina, the traditional burying place of Zouz. The attention of Schlemann and Stillman had been drawn to a bill called "Kephala," overlooking the as-

The attention of Schilemann and Stillman had been drawn to a bitl called "Kepista", over-locking the saciant site of Knoissos, but up to the year 1885, when Dr. A. J. Evans secured a quarter of the Kephalis site from one of the foint proprietors, nothing of any real moment had been accomplished. In the beginning of 1800 Dr. Evans was at least able to secure the remainder of the site, and on March 23rd in that year excevation began, and was carried on with a staff of from 80 to 180 men until the beginning of June. Ev the end of-the nine weeks' campaign of exploration about two acres of a vast prehistoric huilding had when uncerthed.

In a passage-way there came to light one of the drat fairly complete avidences of the outward fashion and apparance of the great probletoric race which had founded the civilization of Knosson and Ayossa. This was the freeze painting, almost perfectly preserved. The block of buildings between the west and the sentral course was divided in two by a long-subtry. Sitteness this gaslery and the western wall of the painon in a teng range of what had vidently, been mangaines for the process of oil, and perfesses of ours. Their was coughed by rever of hump excitant wars in any opinion of the painon of the



A SKETCH MAP OF CRETE

narrated about Crete and its inhabitants and their relations to the rest of the Aegean world. It is round finne, the son of Zeus and Europe, that the built of the Cretan legends gathers. According to the stier, Minos is not only the son, but also the "goasty" of Zeus. He receives, like another Moses, the code of laws; he holds frequent and familiar interconces with Zeus. Finally, at the close of his lift, he is texported to the underworld, and the great human five siver becomes the judge of the dead in Hades.

This is one side of the Minos legend, but the Minos who is most familiar to us in Greek story is the great sea king and tyrant, whose vengeance was defeated by the bravery of the Athenian hero, Theseus. When is own son fell a victim to the suspicion of Adageus, the King of Athens, Minos raised a great fleet and levied war upon Athens; and he at length reduced Attica to such straits that King Asques and his Athenians were glad to submit to the hard terms which were asked of them.

Such, then, are the most familiar of the legends and traditions associated with prehistoric Crete. THE HOMERIC CIVILIZATION.

Between the Greece of such legends as we have been considering and the Greece of the earliest historic period there has always been a great guilt of darkness. It seemed as though the marvelous fabric of Greek civilisation as we know it was indeed semething unexampled, rising almost at once out of nothing to this helpid of spleador.

The Homeric posms abone like a bascon light agrees the dark mit which separated the Helias of myth from the Echia of the Schman of the Helias of myth, from the Echia of history, testifying to a spinote that, Sind boen better the darkness, and prophezying of a green that should be when the darkness has pussed. But perhaps the most striking feature of the nesting of the Homeric story is the type of makergal evitings.

[&]quot; Nea Kings of Crete," by Rev. Jampa Balkia, F.R.A.S. With 38 full page illustrations from photographs. Consvey pp. 16 + 874, New York, 1910. The Macmillan Company.

we can be little doubt, says Dr. Brans, "that this dillor, which, is a broad historic sense we are so to calling the Paleus of Minos, is one and some on the traditional Labyrinth." Its bein any of the characteristics of a mase. s, does, in fact,

A STATE OF THE STA

secrety of the very throne of Minos, for may fairly term it, was surely the most and fitting recompense for the explorer's dramatic and mining recompense for the expioerrs' appliance and pensistence. No more ancient throne estimate in Bureau, if probably in the world, and non-wising samething rise so that or interest. This: the discovery which will doubtless prove in the self to be of greater importance than any other way that of large numbers of elsy tablets incised with the contract of the technique of the restriction market of the Mirones.

riptions in the unknown script of the Mincans. As yet, in spite of all afforts, it has not proved pos ble to desigher the inscriptions, but there may yet

These, in brief, are the results of the excavation of the ancient palace of the Cretan Sea Kings, so far as it has proceeded. Of the wealth of material which on brought to light, much still waits for inter-The interpretation and co-ordination of the immense body of material gathered by Dr. Evans must for long be the work of scholars.

PHASTOS, HAGIA TRIADA, AND EASTERN CRETE

The excavations at Knossos are very far from being the only important investigations carried on in the island of Crete. It would still have been possible, from the results of the excavations made at other sites, to deduce the conclusion which has been arrived at as to the supreme position of Crete in the early Aegean civilisation. Both in the Iliad and the Odyssey, Phesics is mentioned along with Knossos as

temples. The reason of this appears to be that the Minoan religion was of an entirely domestic char-

Such, then, was the empire of the Minoso Sea Kings as it has been revealed to us by the excavations and researches of the last ten years. Perhaps the most striking and interesting result that has been at tained is the remarkable confirmation given to the broad outlines of those traditions about Crete which have survived in the legends and in the narratives of

An Automatic Humidifier for Workshops

RECENT investigations in industrial hygiene have or artificial means, a moderate and constant degree of humidity in the atmosphere of factories and



Clay tablet and linear script, Kno From Bulkie's "The Sea Kings of Creta

come to light some treaty between Crete and Egypt, which may enable us to read the original records of this long forgotten kingsion.

e important discoveries of 1900 were evidently far from having exhausted the hidden treasures of the House of Minos. Among the other treasures re-covered (in 1901) was a quantity of fine painted potcoverence (ma. awa), was a quantity of fine painted pot-tery. Some of the fragments were of that early polychrone style known as "Hamagree ware." Of the later postery of Sinosees, which substituted naturalis-tic modifies, executed in monachrome, many speci-ments style state deman.

ness were also frome.

"Heat dibyrights of Sil, however, in many respects, say the rewelation of the handsingly complete system of brighings with suited they plained our percented. Infield, the hydraulic selections of the Stateson architecture molitorios. In: the dompteness with
highly provided for even the smallest details. Those The transformer we many extent descriptions of sani-ry arrangements will best appreciate the care and videought with which the Minosa-architects, more any \$100 years between had provided for the sanita-ment the great findness of Minosa.

AND STATE OF THE S

REMARKABLE CRETAN RELICS

Main drain, Knoss

Terra cetta drain pip

one of the chief towns of Crete, and it is at and near Phesitos that the most extensive and important remains of Minoan culture have been discovered, apart from the work at Knossos. The result of the work carried on has been the revelation of a palace, similar in many respects to the House of Minos at Knossos.

But as contrasted with the sister palace, the stately building at Phesics has exhibited a most extraor-dinary dearth of the objects of art which formed so great a part of the treasures of Knossos. The hill of agia Triada, about two miles to the northwest of Phestos, proved, however, sufficiently fruitful to com Pheeston. The artists of the time worked not only in the precious metals, but also in stone. One of the Hagia Trisda finds is a limestone sarcophagus covered with plaster, on which various funerary ceremonies are painted. At Palaikastro, another town, a space of more than 400 by 850 feet has been revealed.

LETTERS AND RELIGION.

As to form of worship, the most striking feature is the seemingly total abs mos of what we should call shops, but the problem is difficult and most of the proposed solutions are imperfect. The simplest and most obvious process, the admission of steam into the room, causes wood to rot and metal to rust, besides seriously inconveniencing the occupants. This defective and expensive method has now been abandoned and the required moisture is commonly supplied in the form of a spray, the fineness of which must be very carefully regulated. If the drop are too small evaporate too rapidly in a dry hot atmosphere, and if they are too large they produce a sort of rain in a cool room It is, furthermore, very difficult to distribute the mist formed by the spray throughout a large room, so as to produce uniform humidity

Great jar with papyrus reliefs.

The French journal, Cosmos, calls attention to an atic apparatus by an American inventor, J Fries, in which the quantity of spray, or mist, pro-duced is regulated in exact accordance with the hygrometric state of the air, by means of the warping of a ring of hygroscopic wood precisely adjusted to the condition of the air, is carried into and through the room by a powerful blast 

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THE policy of using old battleships as targets is I not a new one, but the conditions under which the recent sinking of the "San Marcos" (formerly "Texas") by the "New Hampshire" was accomplished were so novel as to give this experiment a value which the earlier tests in the British and French navies did not have. The most striking feature was the great range at which the firing was done, the distance be-tween the "New Hampshire" and the "San Marcos" varying from five to as far as six and a half miles for the 12 and 8-inch guns, and from four and a half to live and a half miles for the 7 inch. The accuracy of the fire, even at the greatest range, was surprising and served to show that the methods of finding and holding the target, at present in use in our navy are efficient Fire control was directed from the top very emicient. First control was directed from the top of the military masts, one bundred and twenty feet above the sea, and the target was found by the new system of trial shots and "spotting", in this method a trial shot is fired at the estimated range The of-ficers on the lofty fire-control platform observe through their powerful glasses the splash as the pro jectile strikes the water If the splash is beyond the sel the elevation of the gun is lowered; if it falls short, the elevation is raised. Thus, by trial and

suort, the elevation is raised rinus, by trial and error, the exact range is found.

The "San Marcos," of course, is an old ship, and her 12-inch artmor does not compare in resistance with our later cemented Krupp armor; but the fact that at these great distances the ship should have been found and sunk within a comparatively short time, and this by a pattern of 12-inch gun which is inferior in power to the latest type, has given great satisfaction in the

The real interest and value of the experiment, however, will be found in the examination of the ship itself, and the determination of the actual damage done by the various types of projectiles. The matter of the the armor belt and the turret is only one of several questions of importance. As far as pos-sible, the ship was placed in actual fighting condition, even to the point of having steam up and fire under the boilers. The test of the efficiency of the prothe boliers. The test of the efficiency of the pro-tective deck alone will probably be worth the expense and trouble of the experiment. Because of the great range, the projectiles, especially from the 8-inch guns, must have fallen at a considerable vertical angle of and presumably the protective deck was severely tried.

At the same time it would be easy to draw too strong conclusions from the quick havor wrought on this obsolete vessel. She was a small ship of only 6,315 tons, or less than one-fourth the size of our "Wyoming." Her armor was badly placed. She had twelve inches on the turrets and redoubt, but was unprotected on the deck below Her 12-inch belt covered one-half of the waterline; beyond the belt was merely a 3-inch protective deck.

But after all said and done, the photographs tell dramatic story of the havoc wrought by the 12, 8, and 7-inch 45-caliber rifles of the "New Hampshire. The most significant result was that obtained when a 12-inch shell (presumably a high explosive) pierced the conning tower; burst and blew one side of the tower, weighing surely 15 to 20 tons, entirely away, hurling it to the main deck below. The same shot entirely wrecked the bridge. The chart house and avigating bridge was blown completely away, and with it must have gone steering wheel, compass, voice tubes, telegraphs and every means of navigating the ship.

Below we append extracts from a statement issue by the Secretary of the Navy, which is full of thrilling interest:

'The 'New Hampshire' placed the salvos anywhere she wanted, and when the gunners wished to have some hits on the conning tower and the turret armor in order to observe the effect they had no trouble placing the shots at from ten to twelve thousand yards range at just the point desired

A few projectiles were directed against the masts, so as to show what would happen to the exposed con munication systems

'An inspection of the vessel after the firing showed

immense holes which had been ploughed through freez one side to the other, many of them being below water and any one or two of them heing sufficient to make the vessel a total loss. The agreem of this vessel was unable to withstand the impact at the very great range at which we fired, and the hastleship was a total loss after the first two salves we

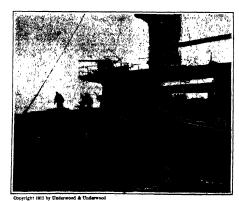
"All the officers of the fleet were desply im "All the officers of the fleet were easely impresses with the securery and the great destructive effect of the projectiles. All the manifains which were placed at the guns representing the crews were desadfully out to pieces, and the furnes and fire last far, the passage of high explosive projectiles would have destroyed overy living thing. The buikheads is algoes were like sleves due to the action of high explosives, and

all the compariments below were completely riddied.
"It was remarkable to note the enormous power of some of these projectiles, which at 13,000 yards went through the heaviest armor and continued their work of destruction inside of the vessel. This practice has demonstrated beyond doubt the immense value the long range firing we have been having for the last two years, and shows that our methods of training are positively the best.

There was no doubt that the 'Texas' was a total loss very shortly after the firing began, and all hopes of raising her were given up. There are a dozen places where holes from four to six feet in diameter from side to side, cutting away decks, beams, bulkheads, stanchions and armor as if they had been made of paper

"The under water hits, of which there were a great many, did the most damage, and the fact that the vessel sank at the second salvo of high explosive projectiles prevented many fires that would otherwise have been started. As it was we had a roaring furnace on the gun deck in two different places as the conning tower, which the two fire turn got under control after an hour's effort.
"The upper works were absolutely riddled.

There was not a single halyard or a means of communication



Lee side. The after bridge and a 6-inch gun with portion of an



side. Group of 12-lack sh aking into the ship. Note ip. Note that muscle of the gun is a

2

The chart house was a mass of splinters after the main projection, and the decks were out through, as it is maintained by the chart had done the work. The complete was a man destruction. Of the singuists will accomplish the same destruction. Of the singuists with complete his same destruction. Of the singuists which were actually directed at the target the previousness of hits at that great range was away begind expociation. The spotters have for the first time shind, the necessary information which cannot be signed by firsting against anything but a real vessel."

1, 1011

yand exponention. The spotters have for the first time splined, the necessary information which cannot be integrated by firing against saything but a real vessel." "Spo 'much prize cannot be given to the navy for the abstractic results shore recorded. They have been consisted possible, only by the co-ordination of the various departments that have been concerned in the design of the ships, the gune and their mounts, the problem and the shells with their delicate tuses, and in the training of the gunners who have shown such and ye covered at unprecedentedly long ranges.

The American people have heard much of late years about the excellence of our target practice. Thanks to the camers, they can now iddge for themselves.

Internal-combustion Engines for Industrial Power in the Southern States

By T. C. Butler, Jr.

N the South, which is inleady claiming the attention of the world by reason of its varied and rapid development, the inherent-combustion engine is rapidly elimbing into a high position in the industrial field. Large power companies, who of necessity have to reduce their power-producing to a basis of hard dollars and ceate, have found that for both the steady grind of all night and all day service and for the sudden additions of power required for entergony service, the internal-combustion engine saves dollars every time it turns a wheel.

At the Davis Street power station of the Georgia Raliway and Shectric Company in Atlanta, Georgia, Raliway and Shectric Company in Atlanta, Georgia, the Snow Steam Pump Works have recently compared the erection of a thres-thousand-horse-power gas using, which, at the time of its completion, was the largest single unit of its type in the world. The mackine was such a success, however, that it was immediately accepted as a type, and has since been erected in somewhat larger units in different parts of the country.

This machine has four cylinders, connected in tandem, two to a side, and looks very much like horordinary double tandem steam engine usually seen in power houses. The cranks are hung on quarters, which is also according to steam engine practice. The platon rod runs in one continuous piece from the romes-head clear back to the tail end of the last cylinder, where it is supported by a side rest to help take up the enormous weight of the siding meas. This piston rod is hollow throughout its length, and a stream of ware is kept constantly running through crank, and with the cranks hung on quarters just as in steam engine practice, the effect of this continuous torque on the crank-haft—as noted in the steady motion of the engine—is truly remarkable. The speed of the engine is anywhere from 180 to 240 revolutions per minute. It is wonderful and marvelous to standard and witch this giant creation of man operating in its slow, majestic rhythm, and to realize that it derives easy is slow, may be to realize that it derives the standard buttle gases. It is an entineering triumph, and a commercial and economic success, a striking monument to the novemes of man over the elements.

As a bit of evidence that this class of power is not being confined to large units, it is interesting to note that there is coming into popular use among the oil mills and fertilizer plants springing up all over the South, a very compact form of three-cylinder, vertical, four-cycle internal-combustion engine, which is open-



below, and the belt are protected by old 12-inch

ated on various forms of fuel—such as producer gas, natural gas, masolins, keroesene, bennine, napiths, alcohol, and distillate, in fact, any fuel that will evaporate or can be made to evaporate. The conventional form of this engine has elyniners with eleventuch bore and thirteen-inch stroke, runs at about \$80 revolutions per minute, and at this speed develops 100 horse-power or \$6 keroe-power, with three cylinders, or two cylinders, respectively. These fertilizer miles generally need poor the premises of the stroke of the control of the seeds and as the necessity for boying cold of the seeds and as the necessity for boying cold of the seeds and as the necessity for boying cold of the seeds and as the necessity for boying cold of the seeds and as the necessity for boying cold of the seeds and as the necessity for the producer range, which is made in a simple type of gas producer right to the penalses. This type of power is proving a boon to these industries, and provides cheep and shundant power at infermittent seasons of the year without the necessity of creating notice team, nlants.

necessity of erecting costly steam plants.

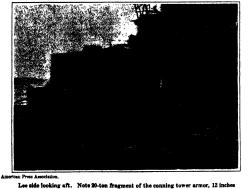
Commercial transportation is also feeling the quickening impulse of individually-powered carriers and
internal-combustion engines. Several years ago the
Genral Electric Company placed in service on the
lines of the Southern Railway Company between An-

radiating fins, rises in a graceful loop over the roof of the car, about four-diffus of the distance forward. The engine has eight cylinders of eight-inch bore and eight-inch stroke, arranged in Vdrom, like the Curties servoplane engines. four cylinders in a row, all connected to the same runnkshaft, the two rows of four cylinders each, being inclined at an angle of 60 degrees from each other All valves on one side, the hadde one worked by one big cambaft which is in between the two rows of cylinders Ignition is by means of high tension magneto and a conventional form of automobile spark plug; the engine has never been troubled with faulty ignition. Starting is by compressed air, furnished by direct-connected pump having an automatic throw-off valve, which throws the pump out of operation, when the desired pressure is attained, this, also, is fully reliable.

The transmission is believed to be absolutely unique and has proven very effective and practical. connected to the front end of the crank-shaft is a differentially-wound dynamo, and this is wired to a differentially-wound motor, which is in turn connected by spur gears to the axle of one pair of wheels in the Transmission is thus by electric current is The engine normally operates at a front truck to the wheels fairly even speed, and is always started revolving by compressed air, when the resistance is cut out of the fields of the dynamo on the crank-shaft, i e, the dynamo is idle and imposes no load on the engine. The car is then started moving by cutting in this field-resistance into the dynamo, and the stronger resistance is made, the more current is generated and resistance is made, the more current is generated and conveyed to the motor on the axle. Thus the speed of the car is gradually controlled from nothing or idleness, up to a full percentage of transmission of power between the dynamo and the motor, until the motor is making revolution for revolution with the dynamo and the crank-shaft of the engine (less, possibly, a little loss of electrical efficiency). This m the ideal form of clutch for so heavy a mechanism. After the car is started in motion, the throttle of the engine is used for controlling speed. The engine is very sensitive in this method of control, responding tantly to the slightest variation of throttle-opening. or the least difference of gradient in the track which the car happens to be running over.

There are three cars in the service, which affords a one-hour schedule hourly throughout the day and night between Anderson, Greenville, and Betfon; none of the three cars have ever missed a trip and they have never suffered any delay through any trouble whatever. The cars were started here in the nature of an experiment by the General Electric Company, which had some sort of a commercial agreement regarding the use of the tracks of this railroad company. The experiment has been such a howling commercial success that the railroad company has now acquired the cars for itself, and is placing in service acquired the cars for itself, and is placing in service





Looking aft. A 12-inch, high-explasive shell entered port side of coming tower, burst, split the tower egen, tore off the roof and produced the complete wront of the surjusting bridge above it, which is have pictured.

thick, blown down onto the main dock. In the immediate foreground the deck is cut across by a 12-inch shell.

SINKING A SATTLESHIP AT SIX MILES

thin order to keep it cool. It alides through stuffing belongs of the ordinary steam engine type, into the cyllidges. A man can issued erect in the bore of these static cyllidges; they are all of the four-cycle principle, and are arranged and contrived so as to get an explaints in each end of each cyllidge, i. a., double scritch, just as a steam engine. With all four cylindies; double acting, each rod is constantly receiving an impulse, whether it be pushing or sulling the

derson and Greenville, South Carolina, a splendidlydeveloped type of gasoline passenger car. These carare shaped like a boat in general outline, with very sharp prow and rounded stern, while the roof is rounded and tapered at both ends, just like the outlines of a boat's bottom. This is to decrease wind resistance, and was adopted after careful tests had revealed the material worth of the design. The radiator, a cellestien of singared tubes equipped with larger equipment of the same kind, running on more frequent schedules, and is extending the service to other lines.

Attracted by their success, a railroad which was already building from Atlanta, Georgia, southward through some of the principal small cities of that section, decided to use gasoline equipment exclusively, and forthwith abandoned its negotiations for the pur-

5 (Continued on page 811.)

The Heavens in April

Our Monthly Astronomical Page

By Henry Nomis Bassell, Ph.D.



N the present month, the astronomical event of most general interest is the solar eclipse of the 28th For suitably situated observers this will be total, and of very considerable duration—almost five min-utes at maximum It will be very hard work, though, to secure such a suitable situation, for, as in the last long total college, the whole track of the shadow lies in the

Pacific Ocean, and only a few small islands are available as stations. The eclipse will indeed be total just at sunrise in a very small region at the southeastern corner of Australia, but for this station the sun will be barely above the horizon, and too low for satisfactory observation.

Certain islands however, are more favorably

placed, and from some of these at least two British expeditions, and doubt less others will watch the photograph phenomena, pnenomena, pnotograph the spectrum of the solar atmosphere and corons, and secure permanent rec-Sun's surroundings on date if only the weather permits all this! Fortunately, the proba-bilities are said to be very

Almost throughout the Almost throughout the United States the eclipse will be visible in its partial phases. The States along the Canadian boundare too far north to get into the penumbraor outer fringe-of the Moon's shadow; but at all points south and west of a line drawn through Washington, Chicago, and Portland, Oregon, some-thing will be visible Those near the line will see only a small portion of the southern limb of the Sun sourcern into or the Sun hidden, but observers near the Mexican bound-ary will find more than half the sunlight ob-scured, and in southern Mexico the eclipse will b nearly total—the actual track of the shadow lying about 100 miles off the

In California, the eclipse will begin about 3 P M (Pacific time) and be over long before sunset. Observers farther east will find the beginning later by their local time,

the view before the eclinse is over for all points east of a line drawn from Galveston to Cleveland. the Atlantic Coast very little can be seen before sunset, and north of Maryland nothing at all.

As is usually the case with great solar eclipses, this one is isolated, the Moon being too far from its node at the preceding and following full Moons to enter the earth's shadow

Whether we are in a position to see the eclipse or not, we can in any case find much of interest in the starry heavens, which every clear night open to our Even the smaller constellations have much that is noteworthy to show us, especially if we have a small telescope at our disposal.

Take for example Cancer, which we may find, as map shows, a little to the southwest of the even the most active imagination can trace little resemblance in their arrangement to the crab shown in our initial letter. But on a clear moonless night the cye is immediately struck with a faint cloud of light, like a stray fragment of the Milky Way, about half between Caster and Polluz on the one side, and Regulus on the other. This object (called by the ancients Presepe the Manger, while the two stars near it are known as the Aselli, or Donkeys!) is shown even by a field-diams to be a element of stars of the seventh and eighth magnitudes, invisible singly to the naked eye, but impressing it by their combined light; Telescopically, it affords a very fine low-power field. The star s (Iota) Canori, shown on our map at the The star s (10ta) Chancel, shown on our mag at the north of the constellation, is a fine write double, with component of the fourth and sixth magnitudes 30 seconds apart. A powerful finel-giass should divide the pair, but sheecopic sid is necessary to show the contrasted colors (yeallow and blue) of the components. More interesting, though demanding higher telescopic power, is 4 (Esta) Cancel. This star, though not shown on our mag, can be easily found by carrying a line from Castor southward through Pollur sigh dropping a perpendicular from Freesepe on this. A small telescopic

stars looked as faint as Zeta Ca would be invisible nants.

reates influences. Turning our map to identify the remaining constallations, for find Turns, Orion and Gants Major-low in the weig. Canis Minor and Gentia shows them, Auriga and Perseus in the northwest, Cassiogsie, and Cupheau blight the Pole. Preson and Uras Minor farther to the right, and Uras Major high show them, almost overhead. The very bright red star, nearly due east, is Arcturus. Below and on the left are the Northern

Crown and Hercules, the latter rising. The bright star in the southeast is Spice, in Virgo. The still brighter object below this is the planet Jupiter. is high in the south, and below him the sea-serpent, Hydra, drags out its mighty length, extending far toward the southeast, while the Crew and the Cup stand upon its back.

THE PLANETS. Mercury is now an even-ing step in Action hest visi-ble allow the Litch, when he in darthest from the His 'apparent 'diszance from the letter in manon from the litter is just under 30 deg, but be-sing well to the north he is favorably placed for ob-servation, setting about 8:15 P. M. He should be readily visible as a bright twinkling object, almost equal to Sirius, about 15 deg, below Venus, and very ear Saturn (with whom he is in conjunction on the 10th). Mercury is the more northerly of the two, and much the brighter.

Venus is evening star and exceedingly conspicuous. On the 1st she sets about 8:45 P. M., while at the end of the month she remains in sight till nearly 10 o'clock. She is so bright that her light. passing across a room from a western window. makes an easily patch on a white wall, and she is easily visible in the daytime if the eye has only some guide to her position.

An excellent one will be furnished near moon on April 1st, when the Moon is close to the planet—the two, as seen from our latitude, being separated by only about half the Moon's diameter.

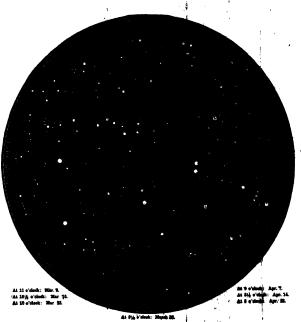
Mars is morning star in Capricornus and Aquarius. rising about S A. M. in the middle of the month. Pagage leagh. Am in the nations of the month.

Pagager leagh. Libra. He is in opposition on the 30th,
said is visible hit night, though early in the month he
done, sid: rise till nearly two hours after numer.

Satura is evening star in Arios at the Degitizing of

the mouth, but is steadily being overtaken by the Sun, es behind kim on the 20th. Uranus is in Capricornus, and is in quadrature with the Sun on the 30th, coming to the meridian at 6 A. M. Neptune is also in quadrature on the 5th, but is a the Sun, and souths at 6 P. M.

The Moon is in her first quarter at 1 A. M. on the 8th, full at 9 A. M. on the 18th, in her last quarter at 1 F. M. on the 21st, and new at 5 P. M. on the 2 She is nearest us on the 2d and on the 20th, and farnee in necessit up on the Fe has in early and the String and the Categories of the 18th. She is in early entire the String and Vanus on the 18th, Neptune on the 18th, Justice on the 18th, Transe on the String String on the 18th, Transe on the String String and Heritage on the 18th, Princepton University Observatory.



NIGHT SKY | MARCH AND APRIL

scope divides it into five components of se equal brightness, and a higher power shows that the brighter one is itself a closer pair.

The stars of this sire in orbital motion at other, and have completed two revolutions since the first observation by Herschel in 1783, the period being sixty years. At present they are near their widest separation, at an apparent distance of one second of arc, and can be seen double with a four-inch aperture. When closest, as in 1870, they are only half as far

apart, and only a larger telescope will separate them.

The third member of the system is in slow revolution about the binary pair. So far, its motion has been nearly uniform, and if this continues to be the case, the period of revolution will be about 700 years. The motion of this star is not uniform, but shows

The motion of this star is not unitoreal, but shows a succession of very similar loops, each of which is described in about 13 years. The most probable arraphantion of this is that this starh has beart empandon of meas comparable with ities!. The center of gravity of the two moves in a monoth curyes about this distant pair, while the visible star, descriping a small orbit about this moving center, is drawn into

Careful observation with the most powerful as



Handy Men's Opinions of Handy Man's Workshop

Merkahop

Merkahop i Handy Mon's Workshop is preatly

measuraged by the hearty and overscheiming support given him in response to the referendum. Mony

valuable suggestions have been received. But of all,
a sumber of readers have presented problems on

which they wish the help of a handy man. One man

right up to the back door of my house. I know that
I oan buy a good coasuum olosseer to be run by this

posper, but it is pretty capsentee. Con. I have a barrel

for the sanh, have cater in the bottom to catch the

dirt, ste. Where can I buy the hose and nouse! Has

anybody worked it out along this line? Another

reader requeste a description of a self-inding elec
tric clock, a scretess telephone, and a hand power

tos machine. Still another reader would like to have

practical suppestions for building aeroplanes. The

Edder vectomes queries of this sort, dis hopps that

there will be a ready response to them.

Only one man has rested his voic against the Bay
periment. He soys: "The Handy Mon's Workshop's

Only one man has related his voice openant the Bysperiment. He soly: "The Handy Mon's Workshike in your paper appears to me to be like a mechanic ustiningtonic tools going to worsh with seve and hatchest and nalls in his pocket. Of course, this is all right for a beginner, but if I would hire a good compenier I should appect him to come with hommer, hand as, rig gam, hand seus, not loo active according notice at and not solih a combination tool suitable for all purneas."

Be for there has been such a landslife an force of Hangy Monte Workshop that the School a land was been close the polls. Men who are hands with book are solden handy with the pen, but the School cours not help on the land was been for any literary effort. He wont it we opinious of all readers of this Department written in the handsest way.

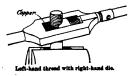
Cutting Left-hand Threads

To the Editor of Handy Man's Workshop:

I was very much interested in reading in your issue of the Benwrine Assumers of the 185h of Ostober last a suthod by A. F. Bishop for cutting a left-hand thread with a right-hand p, and as a layman fond of mechanical would like to give a description of a simpler method of cutting a left-hand thread with a right-hand dee, also a suchod of threading a nut to

fit the same with a right-hand tap.

Take an ordinary stock with split dies, discard one



die and substitute a piece of noft red copper similar in size, signitity bevelad where the test should be to allow of its being canted. Fix your rod in the vise and apply the, stoot and die in the usual way, but with the end of the stock nearest the steel die canted supward. Then tighten up the dies, and with a slow motion work the stock stackity to the left, and after a chuple of turns is will be found that the copper die has taken the tappression of the testh, and the dies can now be tightened and the thread out to any depith without trovible.

To nut the above row must use the ordinary thread.

depth without trouble.
To sut the above, you must use the ordinary threefluids tags, filling in two grooves with soft copper wire
to yet two sets of teeth out of action. Secure these
wires both at top and bottom by binding the ends
with fine brass wire, and colering them to make
them right; trim the copper wire with a file, and
when sillinghe tap a bindir not, worsing left-handed,
which after a few triple it will be found quite easy to
with after a few triple it will be found quite easy to
with after a few triple it will be found quite easy to
with a best and make it serviceshie for ordinary or
with a best and make it serviceshie for ordinary or-

pill deiet.

W. J. Haver,
Mills Burveyer, Imperial Chinese Contons.

Ecotom Contons, Lock Smithigs, Hong-Long.

A STATE OF THE STA

A Wire Stretcher

As a guy for a flag staff, for a clothes line or to Assigned a curtain, or for any other purposes too aumerous to mention, nothing is better than a tighly stretched wire; but it is somewhat difficult to properly tighten, and source one without special appliances. The one herewith illustrated, while it is special, may be very easily made and used by any one. It is nothing more than a common both, with the head removed and with an extra nut, as shown in Fig. 1.

Having secured one and of the wire, bore a hole of the exact size of the bolt in the tree, post or limber to which the other and is to be attached and drive the bolt in nearly up to the first nut. Pull the wire as tightly as possible and bring the end half around the bolt between the nuts, which have been left far sough apart for that purpose, then screw the outer one down tightly upon it. Be sure to have brought the wire over the bolt on the right side so that when



Solt prepared for stretching wire.



The wire stretcher in use

the nut is tightened and the bolt begins to turn it will tend to be wound on rather than to be unwound at the bolt begins to turn press the wire inward till the bolt begins to turn press the wire inward till the bolt of the believes and works to first it then, if you believe the bole at right angles with the direction that with the standard tension is attained.

Of course, the size of the bolt required depends upon the size of wire used, but the relative sizes shaws in the Illustration are about right. A very great strain may be attained in this way, and it is stockardy that the object to which the wire is fast-weed be very from. Under ordinary conditions no strain which the wire will withstand will be sufficient to pull the bolt around and unwind it; but, if it seems expedient, it may be made unquestionably secure by mading a block of wood so that it will be artificially against the side of the outer nut. If one desires a specially neat and secure job, he may mortize out a block to fit the nuts and fasten it over the whole.

Calipering Webs and-Chambered Holes

THE novice is quite any to be baffied if required to caliper a chambered hole or the web of an H-shaped piece. He may close the calipers on the web, but he cannot remove them without loosing the measurement. In the Schenvier America of March 4th, one solution of the problem was published. It consisted in providing each leg of the calipers with a mark made by a price punch, so that by setting a pair of dividers to these marks when the calipers are closed on the web, and then setting the calipers to the



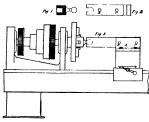
Calingring webs and chambered holes

dividers when they have been removed from the web, the desired: measurement may be obtained Another method which is shown in the accompanying engraving is to use a second pair of calipers to callper the flart-pair which its points are 4n contact with the web. A chambered hole may be callpered in the same way, as illustrated.

Machining Balls and Sockets By H. D. Chapman

The accompanying drawing shows a tool for forming ball ends, and the way it is used in the laths. We had about three hundred ball ends to machine for connection rods for pivot bar sights. These ball ends are made of bronze. How to turn them was quite a problem, and Fig. 1 shows the ball which was to be turned, Fig. 2 the special tool we made, and Fig. 3 the way in which the tool was used.

The first operation was to rough the balls to within 0.02 inch of the required size, so that we could finish them to size with the special tool. The tapered pro-

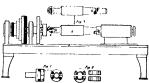


Method of turning ball ends.

portions were finished at the time that the ball was roughed.

The rig consists of but two parts, the tool which is shown in Fig. 2, and the angle bracket A for holding it. The tool, Fig. 2, is a piece of flat tool siecl with a parallel hole, the diameter of the ball, and ground to clear the neck of the ball. It is provided with two taper holes B and C. The bracket A is an 1-shaped casting tongued on the under side to fit the tool-post T-side to that it will not slip and can be boiled to the cross feed. The bracket A is grooved out to the width of the tool, Fig. 2, and of the correct height, so that when the cotting face of the ball is square with the cross slide until be on the line of the inthe, when the cutting face of the ball is square with the cross slide until it reaches the conference of the context, then the ball is finished. The non-untiling half of the tool acts as a support in one direction, from the thrust of the cutting half.

This kind of a tool worked quite satisfactorily and did the work in half the time that was expected A large number of sockets were made on a speed lathe as described below. In the accompanying drawing the sockets are shown in Fig. 1, while Fig. 2 shows the caps for the sockets. The speed lathe was



Method of turning sockets.

rigged up with a special tool, as shown in Fig. 3. The socket joints were machined all over to a finished size and then sent to the speed lathe for the ball seat to be made.

The taper shank of the special tool was made to fit the taper in the tail stock. A slot was crul through the face of the center carrier at A and a hole was drilled through the taper shank of the tool and a $\delta/\delta f$ -lack dowel was driven in this hole as shown at B, and where the tool was placed in position the dowel pin B would seat itself in seat A in the tail stock, thus preventing the tool from turning in the center while the tool was cutting the work

This tool was gotten up at a slight cost in comparison with a nose cutter it consisted of three parts, the holder E, cutter C, and locking In D. The cutter C was made of tool steel hardened and ground all ower, the largest size of the cutter being that of the finished size of the ball seat One quarter of the cutter was cleared away at the top and bottom The cutter C was held smuty in position by the locking

pin D drawing the two ends of the teol holder together, thus causing enough friction to prevent the tool from turning. The ball caps shown in Fig. 2 were machined in the same way.

An Emergency Bit Brace By Claude L. Wooliey

I T often happens when one desires to use a bit in a corner, that a ratchet brace is not at hand, or that when a bit is required for use no brace at all is at In such a case a door knob from any con



vertent door may be used. The source hole in the knob will permit of its being slipped over the sh of the hit and the hit may then be turned quite sucfully by grasping the knob with the hand.

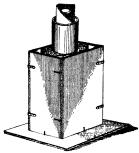
Making Concrete Tile By Charles J. Hackenberg

CONCRETE tiles become harder and stronger with age, and may be made as porous as clay tiles; in comparison the clay tile becomes water-soaked and disintegrates in the years of service, thus causing broken tiles and a useless drain. The accompanying sketch shows a device for making a 6-inch tile, and from this explanation any other tile may be easily constructed.

A box form is built of two boards, 18 inches long and 8 inches wide, and two boards, 18 inches long and 10 inches wide These are joined together to make a form, the inside measurements being 8×8 inches and 18 inches high Fasten these boards to-gether with two hinges at each of three corners, and the fourth corner fasten with two hooks and eyelets. This allows the machine to be folded back from the tile without injury. Now nail in each corner of this box some three-cornered strips 18 inches long, but nail

to one side of the board only.

For the core take a 6-inch stove pipe, 24 inches long, and inside the same place a 4-inch board, 30 inches long, nailing it securely. The top of this board is cut to make a handle to draw out the core. The bottom is cut down to leave a small %-inch projection or pin, which enters into the holes bored in



Mold for making concrete tile.

the pallets, thus centering the core in the form. The pallets are made of any boards larger than the form used for molding the tile and in the center is bored a %-inch hole to receive the pin on the bottom of the rd in the core

The outside part of the mold is held in position by four iron pins or spikes Set the casing in the cor-rect position on the pallet, and then on each side mark where the pin is to be placed Bore a hole for the same, and arrange it so that it can be easily inserted and removed.

A pallet is prepared for as many tiles as you wish to make each day, and the tiles are left on it for at may be piled up and the pallet used again.

In operation the mold is placed in position on the

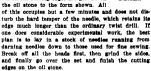
paliet with the core in place. The mortar is placed in the mold and tamped down. Add mortar and tamp down until the mold is filled. Now simply draw out the core and unbook the sides and fold back from the tile, leaving it upon the pallet to dry for forty-eight hours. The tiles thus made are 18 inches long and are octagonal, which is a convenient shane for laying.

A great advantage of concrete tiles is that each is perfect, while the clay tiles are very apt to draw out of shape in burning, and thus make trouble when laying them.

Kinks from an Amateur's Bench By John D. Adams SMALL DRILLS

OR making small holes, from one-sixteenth to one sixty-fourth of an inch in diameter, the twist drill has to be handled very carefully on account of the small actual cross section of metal. Partly for this reason and partly as a matter of con-

venience the writer was led to make some drills from ordinary cambric sewing needles. The results were quite satisfactory, both as regards cutting qualities and durability. Referring to Fig. 1, it will be noted that the needle shank widens out a trifle to form the eye. Break off the eye with the pincers, secure the needle in some temporary handle, and then grind it rather flat on each side, after which the cutting edges are ground on

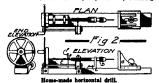


Eig. 7.

A drill from

SMALL DRILL PRESS.

While a small breast drill is indispensable to the experimenter, it is not very satisfactory when using small drills. It requires considerable experience to drill straight, and it is almost impossible to hold the drill steady enough to avoid widening the hole town the top To obviate this, the small "drill press" illustrated in Fig. 2 was improvised—all at an expense of fifteen cents, the cost of the small pin vise. These fifteen cents, the cost of the small pin vise. These vises consist of only two pieces—the shank A, which is threaded on one end, and the taper nut B, the tightening of which closes the jaws. The shank is usually knurled and has a small hole drilled in the end. A bracket C forms the forward bearing, while the back end is supported by a pin D, which is arranged to slide in a groove in the block E. A small arm F affords the means of moving the pin D. and therefore the drill, forward. A bracket G is made to slide on the base and may be clamped by a small thumb screw, which is easily improvised by soldering



a piece of sheet metal into the head of an ordinary wood screw. The drill may be operated by the oldfashioned cord and bow, or by simply passing a piece of string around the shank of the pin vise and drawing it back and forth If the works of an old clock are at hand, it is a very easy matter to arrange some simple gearing like that shown in Fig. 2. The mainspring wheel is provided with a small handle and is spring water is provided with a small nance and is arranged to turn on a vertical wooden standard. The pulley H is made from a small silk spool. A small rubber band, doubled and crossed, forms an excellent belt that is easily replaced and very Sexible in operating, so that a drill will seldom be broken. When using, clamp the base in the bench vise. Crude as this apparatus is, it will drill holes of small diameter of considerable depth and at right angles to the surface without that widening that always results from a drill supported by the hand.

IMPROVISED LATHE.

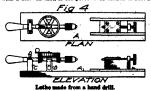
Very often we are required to flash the suff of a small shaft to one of the forms shown in Fig. 3, and on account of the absence of a lathe we are smalled. No matter how accurately we may attempt to wisdle the file, the require will be disappointing unless the

work revolve while being flief. . If a st hand, it may be quickly aroung mired rotary motion and a

Upon the base A is topouted to block B, drilled to receive the block B. drilled to receive the part which holds the handle that prejects from the side of the drill, the adadh. Block O is notohed on top to hold the shank near the handle. A small clamp D serves to keen the action of the shank to the ves to keep the drill in place. A tail stock may be made in many

ways, according to one's needs and the material at hand. The method shown in the drawing is obvious. The

body is simply a block of hardwood glued to a thin der strip, which runs between two guide strips attached to the base board. For such work as that indicated in Fig. 8, no tool guide will be necthe whole operation may usually be very neatly done with a file. In fact, if the piece to be turn



the tail stock may be omitted, and the job done with the work projecting from the revolving chuck.

rotary motion permits of the polishing of small she The screw heads, etc., in truly professional style, and it is only a matter of a moment to remove the drill from the wooden base.

A Punch Used in Boiler Show

I N making a numb for outside in boiler iron, the parts which are indicated in the accompanying engraving at A and B are generally made in one solid piece, which is the punch proper, while the part indicated by the letter C is the holder, which is inserted in the power press. Mr. George Clark has hit upon making the part A a separate piece, which is the only piece that needs to be tempered, thus requiring only a small amount of steel when renewing the punch. The piece is more easily tempered, more quickly made, and more economical. In fact, the punch is



Hints from Handy Men

Painting Window Screens. —When repainting window screens and screen doors, give them a couple of coats of white paint, or else use a light tint, in place of the conventional black or dark green. Screens painted in this way possess the peculiar advantage of presenting an unchatructed view to a person on the inside looking out, while a person on the outside is prevented from looking into the house by the reflection of the light from the wire of the screen.

Machining Work Square in a Lathe,—It is considered by some impossible to machine a piece square in a lathe without special attachment. But it can be done quite simply as follows when there is no other Clamp a toolmaker's vise to the face plate, place the piece to be machined in it with snough projection to permit of facing off one side. Then place the finished side toward the fixed jaw and machine the next face, and so on until the desired. work is done. If care is taken in clamping, the job may be done to a surprising degree of accuracy in abort time.

How to True Up Carborundum, —Carborundum and India ofistones soon become worn in spots, and may he out down by the following simple method: Take a flat piece of machine steel and rough-plane it on one aids; or if you can, get a piece of a large emery wheel that has been broken. Next get some No. 40 wheel that has been broken. Next get some No. 40 or 50 enerty, and spread if on the plate or wheel and rub the same as in lapping. When the stone commones to get solicy, clean of the plate or wheel and stone and then put on new emery. Rappest until the stone is perfectly fast, which will only take ten'er filtees minutes. After the stone has been traped up the can be cleaned with beautipe, and it will be as go

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The Inventor's Department

Simple Patent Law: Patent Office News:

Inventions New and Interesting



Louis W. Maxson Principal Examiner of Division Fourte

MR. LOUIS W. MAXSON, whose pic ture is shown, is one of the bes known examiners of the United States Patent Office, and in point of service as

Louis W. Maxeon

ipal examiner is pretty well up toward the top of the list. Mr. Maxson was born in California, educated in the public schools of Norwich, Connecticut, and graduated at Yale College in the class of 1876, subsequently taking the degrees of B. L. and M L. at Columbian (now George Washington) University in washington, D C. For four years after graduating from Yale he taught in col-legiate preparatory schools and then entered the Patent Office as an assistant examiner in 1880. Passing through the grades of assistant examiner, he was in 1889 appointed Primary Examiner and has continuously presided to the present time. Although he has served in but two divisions in his more than thirty years tour of duty in the Patent Of field of important inventions, having been in direct charge, either as principal examiner or as the assistant, of the folexaminer or as the assistant, of the following classes: Fire Arms, Ordnance, Navigation, Signals, Fishing and Trapping, Stone Working, Advertising, Sheet Metal Ware Making, Wire Working, Metal Founding, Packing and Storing Metal Founding, Packing and Storing, Baggage Carriers, Coin Controlled Ap-paratus, Metal Personal Wear Making, Cutting and Punching Sheets and Bars, Wires Fabrics, Parriery Tools, Compound Tools, Metal Bending and Nut and Boit Looks. The practical development of can-making machinery, incident to the restit theresad commercial demand we greatly increased commercial demand for ts of such machines, has occurred

largely during his charge of Division 14. Shortly after his promotion to his present position he was appointed a member of the special committee charged with the examinations from time to time of the assistant examiners, and he subse-quently served on all but one of the dullar committees or boards.

t saly be incomplete, but would also saitively inadequate, if it failed to the same reference to his personality.

judicial functions in the treatment of the jars and jolts incident to the passage

recognized as a leading exponent, to use on automobiles. fruit culture, his success in the latter. Viewing the prese

vision for more than twenty years, he still finds time from his executive work sistant examiner to the blush.

Elastic Spoke Wheels.—A

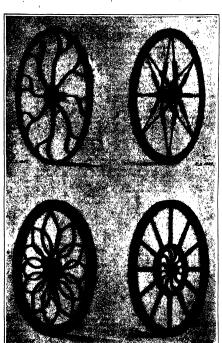
trucks and other freight-carrying vehicles, another form of yielding wheel,

To know him is to appreciate his sym- has emphasized the desirability, if not pathy and to realise that he breathes a the absolute necessity, of some provision helpful spirit. Whether as a neighbor, a in lieu of pneumatic tires for giving churchman, or as an official exercising restlience to the wheels and thus easing puncture applications, the same whole of motor-driven vehicles over rough hearted, cordial, manly man is found, roads. This has led to much activity with a hand stretched out to help wher over help is needed or desired. wheels, and many important advances.

Like most vital, energetic men of his are being made looking toward the prokind, Mr. Maxson has hobbles running duction of an ideal spring wheel with all the way from archery, of which he is especial reference to its availability for

recognised as a leading exponent, to use on automobiles. The success in the latter field, especially with the small fruits, belong the subject of much remark.

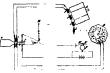
Physically, the subject of this sketch is built on generous lines, and his mind is built on generous lines, and his mind energy are proverbial, and although he energy are proverbial, and although he enter the subject of t patented in France in 1829, and has a wheel with inner and outer rims and to do actual examining to an extent that ordinary spokes between them, while would put the record of many an asbetween the inner rim and the hub. A wheel patented in England in 1830 and shown in cut "C" utilizes coll springs operating in connection with the spoke to give the yielding action, and the THE development of the automobile, wheel shown in cut "D" and patented in especially along the lines of heavy the United States in 1851 illustrates still



The "Telegraphic Eye" By Dr. Robert Grimshaw

THE three accompanying illustrations show a diagram and general view of the latest form of "telegraphic eve" de-signed by Prof Rosing, of the imperial





"Telegraphic Eye,"



The Rösing "telegraphic eye."

Technical Institute in St Petersburg. In the general view both the sending and the receiving station are shown, connected by six conductors. It may be

mentioned that the inventor has recently worked out an arrangement with only three lines of conductors

The sending station is shown on the right-hand side of the plan, the receiving station on the left. The transmitter consists of two rotating multiplying mirrors, A and B, the axes of which lie at right angles to one another; their rates of revolution are purposely made un-equal, and are so calculated that during their rotation every individual point of the image M'N' of the object MN which it is desired to reproduce at the receiv ing station, comes in turn before the orening a of the diaphragm of the photoreceiver F a number of small dynamos p p' p" and q q' q", which, when the mirrors are re-tated, generate electric currents, synchronous with the movements of the minrors themselves, and also with those of the images to be transmitted. These cur rents, as also those proceeding from the electric element F, when the light from the individual points falls on this latter, are reproduced at the receiving station

At this last a pencil of cathode rays produced in a Crookes tube forms an essential feature. In obedience with the electro-magnets s and t, which are ex-

cited by the currents proceeding from the dynamos p and q, the pencil of cathode rays is deflected by varying amounts in rays is deflected by varying amounts in the direction of the two co-ordinate axes, synchronously with the movements of the picture M'N' with reference to the corresponding axis. As a result, the spot of light formed at the point where the pencil of cathode rays meets the fluores-cent screen O will go through the same movement in relation to the screen as the opening a does relatively to picture M' N'. At the same time the spot will change in brightness in proportion to the brilliancy of the corresponding points of the picture M'N' (and hence of the object MN). This result is attained by connecting the photo-electric element F with the condenser C in the Crookes tube, so that the latter becomes charged more or less strongly, in proportion to the intensity of the light falling upon F. The condenser, accordingly, attracts the pencil of cathode rays with a varying force, and compels it to pass more or less completely through the opening of the diaphragm o, and to fall on the fluores-

As Prof. Rösing's experiments hav shown, and as one would expect, considering all that is known of the cathode rays, this form of electric telescopy has yielded results such as have been ob-tained with none of the earlier forms of apparatus, in which mechanical move-ments are made use of at the receiving We know that the cathode rays have practically no inertia, no friction, and are not subject to vibrations; in other words they possess none of the un-desirable properties which limit the action of the most perfect mechanism, especially considering the great velocity of motion required in the reproduction of visible signals by means of the elec The time admissible for tric telescope giving a signal may here amount to only a few millionths of a second

The electric telescope here shown is of course, not to be considered as the ventor has already found it nece introduce some improvements; and there are still certain obstacles to be overcome This will be understood by all who have This will be understood by all who have had to do with electric telescopy, and who therefore know what difficulties stand in the way of a solution of this problem. Nevertheless, in view of the giant strides which physics has made in the investigation of electric and optical phenomena, and of the aid afforded by the refined instruments which science has given us, there can be no doubt that the solution of the problem is near at

It is not necessary to emphasize in It is not necessary to emphasize in a great detail the importance of electric telescopy. Apart from the fact that it allows us to see through obstacles and to span any distance, as though we viewed things with our own eyes, new possibilities are opened of seeing that which no human eye has yet perceived By fitting this electric eye with a strong electric lamp and sinking both together to the depths of the sea, we shall be able to systematically explore the ocean bed. It is difficult to say what innumerable scientific and material treasures are hidden in the unknown portions of our globe. Such an apparatus can also be employed for researches concerning the crust of the earth by letting it down into volcanic crater, into chasms and crevices of mountains, or to the bottom of deep ariesian wells. Electric eyes will most probably be employed on ligh houses and at military nosts. With the heip of this eye the commander of an army or of a fleet, working with the aid of an airship, will be able to obs the movements of an army or fleet And finally, this invention can be of great service in the industries by enabling the engineer or superintendent to inspect his plants, shops, and other installations from his desk or office. In fact the pos-sibilities presented to our minds are apparently inexhaustible.

Patent Oddities

Hollow-ball Gun Muffler,—Our atten-tion has been drawn to a very regret-table error in an article and illustration which appeared on pages 85, 96 of our issue of January 28th, a form of gur muffler invented by Mr G. F. Children being erroneously ascribed to Mr. Maxim We are anxious to correct this mishan



and to give credit for this invention to the rightful owner. The following is a somewhat more detailed description of the Childrens gun-silencer than was given in our earlier publication. As shown in the accompanying diagram (which is reproduced from the drawing of United States patent 953,943, issued to G. F Childress on April 5th, 1910) there is attached to the nozzle of the gun a prolongation or cylindrical case containing a number of hollow balls Each ball is traversed by a perforation normally placed in alignment with the bore of the gun, and serving for the passage of the bullet. The ball is made of two halves, each approximately hemispherical in shape, and strengthened by a median rib or septum lying in a verti cal diametral plane The function of this is to prevent the ball from being crushed by the force of the blast at the explosion. Each ball is held in place by two annular shoulders running around the inner wall of the muffler case gases, as they sweep out from the ex gases, as tasy sweep out from the ex-plosion chamber, are caught in the series of hollow balls, and thrown thereby into rapid eddying motion, this action being also aided by the median partition within the hall In this way the pressure of the gases, as they leave the nozzle of the gun is reduced some what gradually, their energy being dissi pated through the eddying motion pro duced by the sudden discharge.

Automatic Poultry Duster, -Realizing that dust will kill lice fowls will avai themselves of every opportunity to dust themselves thoroughly. However, it is difficult for the fowls to apply the dust to their backs. When the dusting of fowls is done by an operator, the dust is quite liable to be taken up into the lungs, re



Antomatic poultry dus

sulting in discomfort, if not actual in jury. For this reason an inventor has devised a scheme whereby a fowl can dust its own back. It consists of a receptacle formed with a perforated bot

arranged to slide over the



sion on the handle of the fi

so that when the flour sifter is grasped hand the sifting foot may swung from side to side by merely grip the handle.

Runner Attachment for Whe -An inventor who halls from the North west has found it expedient to remove the wheel from his wheelbarrow in winter time and to substitute in its p



sled runner. The runner is formed with a crosspicce which fits between the bars of the wheelbarrow and is attached thereto by the axis rod of the wheel-As no special adjustments are necessary, the runner may be removed at a moment's notice and replaced with the ordinary wheel.

Combined Ironing Board, Step Ladder, and Clothes Rack.—The city home is be-coming so small that any device which combines the advantages of a number of separate articles should be hailed with delight by the householder. The se companying illustration shows a house hold utility which serves three purposes If arranged as shown in the drawing it may be used as an ironing board.



ironing board, however, forms the be support of a step ladder, and when the dévice is set upon its feet it serves this purpose. Furthermere the device is propurpose. Furthermore the device is pro-vided with a pair of folding arms which may be extended to support clothes. When used as an invaing loand the de-vice must be used in connection with a table, the ton step of the single ladder resting on the surface of the table, the end of the ironing board being cause under the edge of the table top.

tom from which a number of rocker pineer, who died at his home in Brook-arms project. As the fowl passes be in the secret of the consensation of the secret of the consensation of the secret of the consensation of the secret of

Daniel J. Sully, at one ton King. connection with a action of tion of a well-k ventor. Mr. Willard Dore and one-half million dollars are

Charles E. Mitchell.—Mr. Charles (Itchell, who was Commissioner Patents in 1889-91, during President ratems in 1885-91, during Fras Harrison's administration, died on urday, March 19th, 1911, at his hos New Britain, Connecticut. Mr. Mi was a native of Connecticut, having was a native of Commecticut, having been born in that State at British. After graduating from Brown University, he attended the law school at Albany, New York, graduating its 1692 and taking up patent law. In the Pattent Ullion, he was immediately preceded as Commensured by Bouton J. Hall, and succeeded by William E. Simonofa, and it is doubtful if there ever was in the history of the Petent Office a succession of three abler men. As Commissioner, Mr. Mitchell showed an ability which put him well up in the ranks of distinguished patent lawyers who have Siled that high edice, bringing to the position an astensive experiaging to the position an extensive ex perience in patent matters which proved of great assistance to him in his con

Investigation of the Henry Patent Applications.—Testimony is now being taken before Hon. C. C. Billings, First Assistant Commissioner of Patents, in the investigation directed to be made by the Commissioner of Fasents of the charges of fraud in various applications for patent filed by John Allen Heany. The purpose of the Patent Office investiga-tion is to determine the validity of certion is to determine the validity of cer-tain applications for patent for electric lighting, and Congress passed an appro-priation of several thousand dollars to cover expenses incurred in the investiga-tion, including traveling expenses, ex-penses of witnesses, cost of copies of testimony and other expenses incident to the investigation. Apart from the importance of the inventions involved, the investigation is interesting and unique, as it is certainly the most extensive, if not the only proceeding of its kind ever instituted by the Patent Office.

The Dental Drill of the Future.—The writer of this note is neither electrician nor dentist, but in common with most of the laity he has spent many hours in a dentist's chair and has noticed him use the dental drill driven from a suspended connected. This is a big advance ever the force-protected drill some of use deleted connected. This is a big advance ever the foot-operated drill some of us elder ones remember; but is it too much to hope, or even predict, that with the progress being made with storage batteries. the dental drill of the near future may be emancipated from the serpentine flexible shaft and carry within itself the elec-tricity and motor, and be re-charged from time to time, when laid down temporarily from a suitable source of supply.

Some Legal Decisions.—The decisions handed down by the U.S. Court of Appeals for the District of Columbia on March 7 included nine patent appeals from the commissioner of patents, all of which were in contested cases and the de cisions of the Patent Office were reversed in five out of the nine cases. Oblet Jusall of in me out or use nine cases. Other star-tice Shephard had eight of the cases and reversed the Fatent Office holdings in five out of the eight cases, while Mr. Justice van Orndit had one of the cases and af-firmed the decision of the Patent Office.

The Pley as a Military We Without regard to the southeaste

the wilds may "and motion inner in-legated their book, said the broad fal-ting the a plowsbare and," two joint displays of New York State in June, The plant is of ordinary construction extabelar to constitute a camon bore, ping a vent hole at its rear end. It is cribed as unrivaled as a means of de-ter repelling surprises and skirmtaking stracks, as it can be immediately beought into action by disengaging the tests, and "in times of danger may be used in the field, ready charged with its deadly missiles of ball or grape." The detaily mission of ball or grape. The share is described as serving to anchor firmly in the ground and resisting re-netl, and the handles as furnishing means of giving direction to the gun.

Commission's Report —The Commissioner of Patents has transmitted his report for the fiscal year 1910 to the Secretary of the Interior. The printed copies have not yet been issued, but it is understood its principal recommendation is for new and larger quarters for the patent ct dear to the hearts of all rested in the inventing public.

Legal Notes

Patent Appeals and the United States Commerce Court.—According to per-sistent rumors, there is considerable prospect of the vesting of jurisdiction of patent appeals in the newly organised United States Commerce Court. This would avoid the necessity of a new Court ent Appeals as provided for in a bill before the last Congress and would permit appeals from the United States Circuit Courts, or what will, after next January, be the United States District Court, directly to the Commerce Court, Court, arrestly to the commerce court, at Washington city. At least one mem-ber, Judge Archbold, of the Commerce Court has had a large experience in the judicial determination of patent causes, and there is reason to believe the court would welcome the enlargement of its cope in the manner above indicated.

The Chartrense Case.—Mr. Philip Mauro, the well-known patent attorney, who, until recently, was abroad, visited Washington during the middle of March especially for the purpose of arguing the selebrated Chartreuse case before the Supreme Court. Mr. Mauro represented the French Carthusian monks, Mr. A. L. Pincoffs of New York appearing for the

Delphine Delmas as a Patent Lawyer.

—A case argued before one of the trib-unals of the Patent Office, and in which Mr. Delphine Delmas, at one time Harry Thaw's attorney, was opposed to Mr. Frederick P. Fish, the prominent Boston Frederick F. Fun, the prominent Sozion patent lawyer, recalled the fact that the writer once saw Roscoe Conkling and Robert G. Ingersoll leaving the Patent Commissioner's room after a hearing at a time when those distinguished lawyers were engaged in active practice.

Cost of Assignments.—The recording of assignments of interest in patents is metimes an extremely expensive piece of business for the Patent Office. An example of this is found in an assignment recently put on record in connection with the agasolidation of two large com-panies. While the assignment only con-tained 14,400 words, which formed the tained 14,600 words, which formed the basis of the recording fee, it affected 1,048 patents, or about one patent to each thirteen and one-half words, of the sasignment. The fee paid for record-ing was sittent (#if) dollars. The rec-ord shows that the labor of preparing file doed for record, dispetting it, verti-rizing, recording and comparing necessary. spreading the deed on the record, & measured in one cierk's time, 171 on, equal to 24 days and 2 hours, th, charged for at 50 cents per hour, rate charged by the Patent Office for is rate charged by the Patent Office for militaines in connection with the re-reds, would amount to \$65.50, or more that five times the amount actually old to the Patent Office for the service.

RECRETLY PATERTED INVESTIONS.

These columns are open to all patentees. The offices are inserted by special arrangement ith the inventors. Terms on application to the divertising Department of the SCHETTIFIC MERICAN.

The weekly Index of Patente issued by the United States Patent Office will be found in the Scientifi American Supplement.

Pertaining to Apparel.

Portaining to Apparel.
TUBR.—M. Y. Andranon, New York, and G.
W. BUURANAN, Peekskill, N. Y. The aim in this
invention is to provide a tube more especially
designed for use as a stiffener in caps and like
articles, or as a protector for needing hats and
for other purposes, the tube being unseedingly
light and feetile to permit of readily bending
it into curved shape to conform to the shape of
the articles on which the tube is used at the

Electrical Berices.

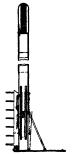
ROBETTE-...D. Natais, Fution, N Y. The diament of the tungsten (electric) ismp is of such delicate nature that it can withstand little and the lamp the form of the lamp the property of the lamp the lamp the lamp that lamp the lamp that lamp

the rosette in applying or removing these screws.

LOCKING DEVICE FOR TELEPHONES.

WA. Sours, New York, N. T. The device is with a support of the control of

COMBINED FOR AND RAKE,—Heasser L.
McKissin, Clayton, Mo.
The invention illustrated herewith provides a combination tool
having a rake member on one side thereof and
a hoe member on the other, each of said parts



COMBINED HOE AND RAKE.

being capable of being folded back while the other is in use. By a novel form of mechanism both parts may be operated funditaneously, one part couning into operative position while the other is folded back out of operative position. The relatively morable parts by which the operations are effected are operated by a headle.

other is folded back out of operative positions by which the foregrations are effected are operated by which the operations are effected are operated by handle.

Foregrations are effected are operated by handle are improvementation of the intensition of the outblet.

Foregration are effected and are provided with centre of the improvement in the intensition of a cubitle provided with centre and an operation of the capacity of the control of the cubic and arranged operation to the control of the cubitlet.

FORTALIZE TRANSIONATION—C.

FORTALIZE HEATING APPARATUS.

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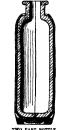
HORRE OVERSHOR.—C. A. CONOVER, 53 Water Street, Newburgh, N Y. This invention refers to horse overshees, intended mainly for the prevention of slipping in instances where the horse is used temporarily in some relations where extraordinary precautions are retions where extraordinary precautions are required to prevent slipping. More particularly



HORSE OVERSHOE FOR PERVENTING SLIPPING

stated, the lowestion illustrated provides two plates to be fitted upon the under side of the foot, which may be already provided with a sloe, these plates being adjustable relatively to each other for fewt of different sizes, and being held in position by aid of straps and wre links. Causa calks may be provided as substitutes for the plates just mentioned.

substitutes for the plates just mentioned.
TWO PART BOTTLE —Eloward N. BreitTUNG, Marquette, Mich. The Inpentor provides
a bottle made in halves, which are detachably
connected tegether by aid of a spring-strap and
are easily takes apart in order to be cleaned.
The improvement pictured in the engraving
comprehends a bottle made in halves, one pro-



TWO PART BUTTLE

vided with a tongue and the opposite one with a grouve flot which said tongue fits, the halves being provided with grooves and being connected tosether by a strop or pring metal control tosether by a strop or pring metal control tosether by a strop of pring metal control to the provided with groove, the strap having a clasp for derachably connecting lies ands together GATE—E CONNIL, New York, N Y. In this case use is made of a frame, perferably adapted to swing on a poet and having an acceptance of the strap of the principle of

enabling a person to move forward on a lake, river or other body of water, and arranged for convenient attachment to the foot, and having sufficient buoyancy to properly support the water and to causile the user to the control of the control of the control without danger of silding backwards.

without danger of sliding backward HORBERSIGN CALK — J. P. VAS WYCE, Hudson, N. Y., De'd, A. B. VAS WYCE and A. P. VAS WYCE, KREENTHER THE INTENDED FOR THE ANGEL OF THE ANGEL

Heating and Lighting.

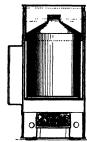
Fleating and Lighting.

PROCESS OF MAKING (AS — J J Nix,
Alhambra, Cal The more particular purpose
in this case is to make a combination gas can
intis case is to make a combination gas can
hart and materials. It comprehends the heating of a furnace or other reveptacle and the
continuous precipitation therein of carionacous material in gaseous form, and the continuous supply to said material, of steam, or
alr, in order to form the combinative gas
PORTABLE MARKETS—Paras v.

PORTABLE STATE—Paras v.

Talia invention is designed for heating water for

invention is designed for heating water

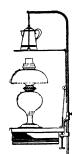


PORTABLE HEATER

buller and other purposes, or for use as a cooking stove in camping. It has in view a heart palvage all the easestilas for heating water, cooking, etc., including a fissk for the furl, a reveal for holding the water or food, and an extra cup or receptacle, all adapted to it placed to the heart with the heater is completely assembled. The body or jacket is uprigit and thoular and has a handle as shown in the engraving, by which it can be moved shout

old Utilitie

PORTABLE HEATING APPRANTIS.—
DORTABLE HEATING APPRANTIS.—
HEATING



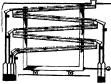
apparatus for use in fashioning orasimental or other articles from antisbly forming sections of pastry or the like, and relates more par-ticularly to apparatus comprising a pan, and a removable momber associated therewith and having means for dividing a layer of dough in the pan and for ministaling the dough signifi-tion of the companion of the companion of the ministry of the companion of the companion of the ministry of the companion of the companion of the ministry of the companion of the

the pan and for maintaining the dough against mainformation, due to apprending while baking. FIFEY CLEANERI --W COLEMA and M. MCL. RAID. WASHINGT, Coan. This invention has wash trate, etc., that have become choiced. It has a tabular bandle through which he cleaning member passes and is adapted to extend to either adde thereof, the handle having an effective spring clamping device for securing point along the breight of the cleaner. COVER ATTACHMENT.—T. McCass, Homestead, Ja. For the purpose of automatically lifting the covers off of bettlers and like vessels without solding or injuring the fingers, the investor provides a bearing with a lever mounted thereon, add bearing being dapted page the cover of the vessel by the knob, the ever being adapted to be disengaged from the vessel when the ball of the vessel engages.

Machines and Machanical Devices, Machines DON PILLING BRIBBIES —O. R. HOWER and M. Grant, Killeen, Franc. In the present patent the invention is an improvement in machines for filling broubes; and the object is to provide a single, effected machine of the character specified which will be expectedly admirated for filling with bristics of the character specified which will be expectedly admirated for filling with bristics. GOTY HOLDER—B. P. Parez, H. S. McLasze, and N. W. THOMPSON, Moro, Ore An object of the invention is to provide a copy holder in which the copy may be held and fed forwardly by the news act of operating the control of the control of the copy of the control of the copy of the copy in the copy of the c

writer, with almost no change in its operating parts MOTTON FOIL LOCAME.—W. POLLOCK STOP IN LINE TO THE PROPERTY OF THE PROPER

the general framework of the machine. CONNIABABLING APPARATIS—ALBIR J. Norr, 4122 Perrier Rivet, New Orienas, La The object of the invention pictured in the ac-graving is to nort out coins of various sizes and deposit the same sized coins in hoppers, each coin heling astimatically registered before passing into the hopper, so that a complete tally of the individual sized coin is recorded.



COIN-HANDLING APPARATUS

The is made for this purpose, of a series of inclined chuttes having baffer and provided with silices having receiving hoppers at their eads for colas, said hoppers being so arranged as to receive coins of ciuliar size only, and means for registering the number of coins in the hopper, and fact without the chuttes to facilitate the movement of coins down the chutes.

AIR LOCK.—W H FLINEATY, New York, N. Y. The kim of this improvement is to propose the construction being such as will sealed a great force to be applied to the doors in opening or shutting them, giving morroom and preventing accidents which usually occur with the wingings type of door al. IRBHIP.—I. O. Bisconsanter, Driftwoods.

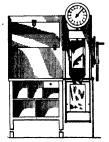
occur with the swinging type of door
AIRSHIP.—J. O. BROSEANK, Driftwoods
Pa. The purpose of the investor is to provide
a simple, strong, and meahanchily efficiant airship, which can be propected with or against
the wind, which can be runsied or, lewelfed in
the wind, which can be runsied or, lewelfed in
the air, and which resists any femineary to disect it from its normal direction of enerological.

COIN-OPERATUD'S of citate color was a color of the color was a color of the color o

weight coins.

FIVING MACHINE.—H. MITCHELL, St.
Paul, Minn. This invention relates particularly to means for automatically maintaining
the equilibrium of the machine, without the
necessity of any physical or mental effort on
the part of the operator. A further object is
for manipulating phases or portions of planes
operated by a pendulum member.

VENDING CABINET.—MICHAEL R. MARINZ,
Zanewills, Ohlo, The accompanying engraving shows a culture from which may be delivered accurately and overlainly the material to
investing are; To provide a dulivery choice
and sack holding scales tray adapted to ac-



WENDING CABINET.

commodate sacks of different dimensions; to provide a bin for holding the material to be handled and significant for leading to the control for delivering the material in the path of the chute previously mentioned; and to provide a cablest adapted to compain sacks and acces-sories for receiving and packing the goods be-ing handled.

ing nanced. WEAVING LOOM.—G E. Levy, 27 Rue du Mail, Paris, France. This invention has reference to a double shedding motion for weaving looms, with automatic maintenance of the open shed, by as automatic device for hooking and unhooking a simple heddle-operating shedding her in the reliefs and invested position, merely her in the reliefs and invested position, merely by the direct action of the card needle

Hallways and Their Accessories, CEMENT AND STEEL RAILEAD ITE—W. J. HOUR, Lamer, Mo In this case the in-vention has for an object, smong others, to provide a novel construction of reinforced con-recte railroad it. The tie susy be made of the small or any decired length and the ties being may be substituted one for the other winnerer for any reason one tie becomes broken or other-vise immirced.

ATTACHMENT FOR DIAPHHAOM FACE PLATES—V. LARADIA Dalles, Texas. This attachment is for use on veribbled passenger cars, and the object of the lawestor is to provide auxiliary wings which have stood portions, and are secured to the rear faces at the use to closes any opening caused by lateral movement of one of the face plates relatively to the other when rounding a cure.

AUTOMATIC CHECK VALVE FOR TRAIN PIPE COUNTRINGS—JAMBE C. KEWREN, NWC Cumberland, Th. This improvement provides a will be bell away from its seet to as to permit the passage of air into the train pipe, but



which, if the main coupling should break and the pipe coupling should fall apart, would re-sent so as to prevent the sudden discharge of air from the train pipes and the sudden set-ting of the brakes.

Norn.—Copies of any of these paints to be furnished by the Scurperries Astronomy ten cents each. Please state the native of patentee, title of the invention, and date this paper.

waw sooms after HE AMERICAN ARTISAN WINDOW DESPL MARUAL, Chicago: Duniel Star 1911. 8vo.; 271 pp.; Hinstrassi.

MATULE. COURTS pp. Simulations south, and the country of the property of the country of the coun

THE FOUNDATIONS OF ALTERNATE CURRENT THEORY. By C. V. Drysdale, D.Sc. (Lond.), M.I.E.E. New York: Long-mans, Green & Co., 1910. 870.; 800 pp.; 190 illustrations. Price, \$2.50 met.

pp.; 190 Illustrations. Price, \$2.50 net. The author endeavore to impart a investege of his subject by the use of simple mechanical analogies. While admitting the general use by teachers of mechanical illustrations of the theory, he helicers that this is the first attempt to give a computer and leafest separation of the reduces the methematical work to a minimum, holds the attention of the student, and gives thin a valuable physical conception of processes and results. Very simple apparatus is sufficient for laboratory work. The author has considered the industry of the control of the control.

Electrical Pocket Book and Diaby, London: Technical Publishing Company, Limited, 1911. 587 pp.; illustrated. Price, cloth, 50 cents net; leather, 75

conta net. This stocky little annual has been brought down to date, and new matter has been fatre duced ou the various rotary-converter equilibries, vistoms; on balancers and boosters; gen metal lie filament hamp, and on the Edison storage cell. Altogether a large fund of information is compressed between its overent, and a few ture of its mateup is the section of blash parce at the back, ruled as a daily recent.

SERHAYENHAU. Von F. W. Otto Schulse. Band I. Allgemeine Anordnung der Seehäfen. Mit 248 textabbildungen. Berlin: Wilhelm Ernst & Sohn, 1911. 8vo.; 359 pp.

Svo. 359 pp.
This work on barbors is, so far as it goes, and the country of the substituting and thorough. A second volume will lasus under the sub-tile 'Assbau und Austatung der Sechlien.' The varying types of harbor are desit with according to there of the country of the co

Engineering of To-Day. By Thomas W. Corbin. Philadelphia: J. B. Lippin-cott Company, 1911. 8vo.; 367 pp.; 39 illustrations and diagrams. Price, \$1.50 net.

39 illustrations and diagrams. Price, \$1.50 net. The man who allows the title of this volume to deter him from reading it, because he knows nothing of engineering, is unconsciously forements of the second of the

Gas-Engine Design. By E. J. Stoddard.
Detroit: Parker & Burton. 4to.; 190
pp. Price, \$1.

Gas-Enguire Liberton.

Detroit: Parker & Buyron.

Distroit: Parker & Buyron.

Distroit: Parker & Buyron.

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The painphist starts with an introduction on compressed sit. It discusses, 'to ordinary handaras, manifer earlier starts with the starting of the start of

The Spources Com Stemm: These ordermees Alfal age from a stemm. These ordermees Alfal age from contents as a state of the content and accuracy the Encolater System almost an accuracy the Encolater System almost an accuracy the Encolater System and the content transactions, increase on the content transactions, increase of the content transactions, increase of the content transactions and the content transactions are also becomes the system and appear in left for the alphaeterial Insertion of private code phrease. As to accuracy, a system of check in furnished by which the companion of the content transactions, increased the insertion and transactions, increased the content and the content an

SUCCESSFED RULES FOR RECOVERING COAL MINES AFTER EXPLOSIONS AND FIRES, By W. E. Gerforth, M.I.C.E., F.G.S. New York: D. Van Nostrand Co., 1910. 18mo.; 71 pp. Price, \$1.50 nst. New York: D. Van Neatrand Co., 1910. ISsno; 71 pp. Price, \$1.50 nat. There are few dissistent that toold so much of potential horror as do those of the ceal mine. The loss of life is any tool of potential horror as do those of the ceal mine. The loss of life is apt to be heavy, and the supervison conditions imposed upon, the two-reserved is the supervison in conditions imposed upon, the two-reserved is an expectation of the supervison and an expectation architecture of the conditions activeding such disease. The active has divided in suggestions into two parts, those desiling with precutions to be taken for guidance after the accident has taken place. The first part considers the appointments, atoms, applicances, welfiledon and the traffing of men necessary to establish a state of preparedness. The second part is graphically interpreted by the use of an admirable plan of The plan is a large linear type linea, and the falls of roof, the bodies, etc., are insidented diagrammentally and the colors. These ruise, then unwritten, were applied to the recovery of the Altoris Pitt and their success in that and in later instances makes them worthy of rendy those prevailing its our own mine the conditions prevailing its our own mine the conditions.

tions prevailing in our own mines.

Occusions Wall, Founce, By A. A. Houghton. New York: The Norman W.

Hanley Publishing Company, 1910,
22 pp; illustrated, Price, 80 cents.

This is No. 1 of a suries of concrete workers'
reference books, and explains the construction
of the various types of wall forms, champs, sepserators, and spacers for reinforcement, treating also of foundations, retaining wells, the
placing of floor joints, modeling where tables
and window indexs, and the modifier of freprod
and window indexs, and the modifier of freprod

clearly described and the control of the control o

with a continuous air chamber.

CONCRIENT PLOUGH AND BIDEWALKS. By A. A. Houghton. New York: The Norman W. Healey Problishing Company. The Royal Problem of the Property of the Property of the State of moisgraphs, and binders shibdres, and proceeds from the simulation of the Problem of the State of the Problem of the State of the Problem of the State of the Problem of the State of th

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WARTHD. A pertuer with sufficient money. Patent No. SELER, whereby an unstitute can open and close his own switch, from the mortan train, by destrictly. W. F. Sats, Blabes, Arisons. WAMPED.--WE WANT SPECIALTESS IN UNIVERSE WANTED AND APPEAL TO SEE IN UNIVERSE SEED AND APPEAL TO SEE A To the information and particulars, adoption flatas, increasing a for. Sin S. Allandas a routine Change. Increasing a for. Sin S. Allandas a routine Change. Incolar Sales BET & TVI W A VYING—Space of the Control of t

INQUIRY COLUMN

The Michelin Grand Prix

(Continued from page 886.)

wind had enabled him to maintain a

wind had enabled him to maintain a high speed.

After a stop of about a quarter of an hour for luncheon, Renaur restarted at 13:00:33 P. M. In an hour and a quarter he reached Moulina. An immense crowd awalted him in the country thereabout. He flew over the city at a height of 1,300 feet and M. Senonque waved to the people that all was well. Pollowing the valley of the Allier he soon reached Gannat (1:37 P. M.), and at 1.65 the biplane was above Riom and almost at its destination. At Clermont-Ferrand, when the town clock struck two, the great crowd assembled about the cathedral and up in its solres gave a cheer as those at points of

spires gave a cheer as those at points of

spires gave a cheer as those at points of yantage were able to discern a grey speek on the horison. Platiner and more distinct it grew and larger and larger grey and larger and

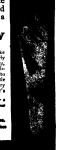


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MR. HANDY-MAN'S WORK-BENCH

MIN. FIGURE 1-WINTED WORK-DESTECT.

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220 B'way, New York 220 B'way, New York.





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SECONDELL'S VACUUM CLEANER

Notes and Queries

Kindly keep your queries on separate shoets of paper when correspond matters as patents, subscriptions, books, etc. This will greatly facilitate questions, as in many case they have to be referred to exports. The fails should be given on every sheet. No attastion will be paid to multaged que to correspondents are printed from time to time and will be mailed on requ

(12409) C. L. F. asks how to silver from, A. Take a small piece of nitrate of silver, and pound it in a morars. Add some soft water to it, mix theroughly and put in a bottle. Flace the brey article to be silvesed to the silver and pound it in a morar and and the silver and pound in the silver and pound of a deep yellow color. To get an until it is a water, and pair in the sum. If desired to fave varies, and pair in the sum is desired to fave and the silver and the same with a some silver and the same water. And pair the same water, and suppose it in the same than the same that the same than the sa (12409) C. L. F. saks how to silver

(12411) C. M. A. asks for formulas

(12411) C. M. A. asks for formulas for heavy and simond cream. A. Bitter almonds, zonew; yolk or egg. I onner; honey, and almonds, zonew; yolk or egg. I onner; honey, of the simonds, zonew; yolk or egg. I onner; honey and decortisated, and rub though a fine slew; then still the second life and the mixture of and decortisated, and rub though a fine slew; then still the second life and the mixture of and beat the whole well until the large-flexis have been thoroughly incorporated 2 Cold cream, D parts, ill off sweet simonds, 5 parts, advertus, 5 parts, borde add, 5 parts; solutions of the second life similar to the simonds and oll of rose, of each q. s to perfume. Hearts, water, 448 parts of the solution of the simonds and oll of rose, of each q. s to perfume. Hearts, water, 448 parts of the solution of the simonds and oll of rose, of each q. s to perfume. Heart the cold cream, oil and sode solution together, stirring constantly, until an enuminion is formed; then heart forgether the enumerical of the similar to the solution of the similar with the enumbion, sitt until cold, and add the perfume.

[13412] J. G. S. says: If two beams

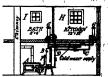
(12412) J. G. S. says: If two beams (12412) J. G. S. says: If two beams of light (either straight or converging) crossed such other at an angle of about 29 or 39 degrees, would it be possible to bind them at their point of crossing so that they would both follow the same axis? If they holt came directly toward wach other, could they be made to do the assum thing.) I have consulted several



positive and the other is signifive all the dis When an alternating current is used by \$ primary, the secondary current is side allow anting. 2. What is the use of the interested pole on an interpole motor or generator? The advantages claimed for interpole motor by their advocates are in the direction of ter ter commutation and its attendant result sparking diminished, less war on comment sparking diminished, less wear on or tors and brushes, less heating, and benefits.

(12415) O. F. says: I am workt an aeroplane and make the front edge as at as possible, Another man with same experi in the building of aeroplanes says it will

(12416) A. J. K. writes: I send you a sketch of hot water heating from a 30-gallon range boiler. A. is the heater and B the 30-gallon boiler. C the return pipe, D the supply pation boller, O the return juga, D the supply-jupe, F snapply to water foat or cylladar, F host water to boller, G the radiators, W the kitchesis (floor space 13 121 feet, helpids 9 feet) has two doors, one to outside Reings seeth, the other to beasement. The batteroom sext to kitchen exposed only on east wall. I would like to know it I could see the hot, water from my range boller for beatting my kitches and hathroom S.



run my pipe and what size to use. A Your circulation is likely to be uper at times when the control of the cont

hol-water system to take care of the expansion strains.

(12417) G. G. askis: How many cubic feet of hydrogen gas would be required to lift; a weight of 275 pounds a distance of 100 feet from the earth? How large would be the compared to the compared to

works on light, but more of them seems to explain if this is possible or how it rould be the seems of the see

4 1816, 1817, 1818, 1819, 1820, 1821 and 1822. The Practice and Theory of Aviation. By Gover Coveland Louise, A. M. The is the most complete paper on aeroplems that has probably over been published. Furties highest and monophorum site demanded in detail.

¶ 1713.

9 1756. Louis Blériet and Aeroplanes. For people realize

¶ 1760. The Farman B

¶ 1767. The Senter plane. An illustrate the Demoiselle, the is the festiat markings

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50 minutes to spape, as the time allowed for the flight was 6 hours.

ction Engines ed from page \$61.) (Con

use of electrical energy. Another rail-id coming from Macon to Atlanta, seeping around in the opposite side of State from the above-mentioned road, road the State from the shove has taken the same step, and all are mov-ing forward with flourishing prospects ing forward with flourishing prospects. A new railway, from the mountainous section of northwesters Georgia down to Atlanta, has declared its intention of abandoning the original idea of electric trains and adopting gasoline power exclusively. All these railroads will be freight and passenger, and will have no steam equipment whatever.

These issuitanted roads, however, will.
These issuitanted roads, however, will.

not use the combination of electrical and gasoline machinery, but will use a me-chanical form of transmission such as is used in automobiles—a manufacture having contracted to supply equipment that will give satisfaction. This will cut out a lot of extra weight and ex-

while it is perhaps too far-fetched a dream to say that the gasoline car will ever displace the long-distance steam locomotives, no more than will electricity, comotives, no more than will electricity, still it cannot be doubted that the internal-combustion engine has come into this new field to stay, and its encroachment upon the domain of steam will be of a greater and more practical extent than has been that of electricity it does not require a central power station; it does not require a heavy steam locomotive and then a separate train for pas sengers; it does not require train for pas sengers; it does not require miles and miles of heavy copper wire, and in fact it requires nothing more than the steel ratis of the old steam roads, and a higher wills of the old steam roads, and a higher rails of the old steam roads, and a higher rails of the old steam roads, and a higher development of the same power which is economically propelling hundreds of thousands of automobiles, large and small, over roads good and bad. Give this new giant; gas, the smooth rails of the grafficed, and the gover which the gas engine low puts into the irregularisaa on the may be seen the magneti-ties of a roadway will be gut into speed and economy, and the new power will show itself undisputably the master of any other power on earth in point of

This is the viewpoint from which the This is the viewpoint from which the twentieth century examines anything new, and if it is not economical, if it does not pay," the twentieth century has no place for it in the ranks of large endeavor. This young stant has been weighed and was not found wanting. He because to stay has come to stay.

Forest Fires

DURING the year forest fires burned over an area of 3,000,000 acres, at a rough estimate at a loss of \$25,000,000 and the destruction of over 6,000,000,000 and the destruction of over 6,000,000,000 feet of timber. Dui'ng 1909 the burned area was 862,014 acres, as compared with 115,000 acres in 1906. It is charged that 110,000 acres in 1306. It is charged that a considerable number of the fires were caused by incendiarism, which has led the department to offer a reward for the conviction of the incendiaries. Precaucommunities to offer a reward for the conviction of the incendiaries. Precautionary means are being employed by the department for reduce the first to a minimum, such as the construction of roads and trails and the establishment of fire lines. During the year 5,500 miles of tread and 15,000 miles of trail were completed. It is recommended that the forests be equipped with lookout stations located on high points, with telephonic communication. The principal causes of the fires are given as the severe droughts and railroad locomotives.

Aeronautics

A Luminous Compass for Military Uses.—It is decided to adopt a luminous compass in the German army, and it will compass in the German army, and it will be used in military maneuvers so as to allow the troops to find their direction without trouble. Very good results are expected from its use. The compass will have a dial prepared with luminous paint so that it may be seen in the dark.

Flying in Sahara.—Aviation is about to receive its practical extension to the French colonies of Africa by Captain Si-do, who embarked at Bordeaux for Dakar do, who embarked at Bordeaux for Dakar recently with four acroplanea, which are to be used in the colony in the postal and army service. Four aviation of, ficers will follow next month, and will be under the command of General Ron-nier. During the first year, when the main object will be to study the atmos-pheric conditions and the régime of winds, the pilots have been instructed winds, the pilots have been instructed winds, the pilots have been instructed to attempt only short flights of fifteen or twenty miles in the vicinity of Dakar, and to keep close to the railway line or highways. They are simply to supplement the postal and medical service, and to keep up rapid communication between the various military posts.

to scop up rapus communitations the various military posts.

Conditions of the London Daily Mail's Circuit of England by Aeroplane.—The conditions were announced last week of the international scorplane race around Great Britain which is to occur between July 22nd and August 5th, inclusive Any aviator having a pilot's license of ihe International Aeronautic Federation is slightle upon payment of a \$500 entrance fee before June 1st. The course is divided into five stages, of which the first—Brookhands to Hendon (20 miles)—will be used to test the speed of the machines The Eastest aeroplane will be used to test the speed of the machines The Eastest aeroplane will be used to test the speed of the machines The Eastest aeroplane will be used to test the speed of the machines The Eastest aeroplane will be used to the second from Hendon to Küthburgh, the second from Edinburgh to Bristot (388 miles); the third from Bristot to Brighton (214 miles), and the last from Brighton to rainburgh of Bristot to Brighton (214 miles), and the last from Brighton to Brooklands (40 miles). There will be problems (40 miles). There will be three or four controls at large cities in each of the long stages, and competitors will be allowed to stop anywhere and make repairs or replacements if forced to do so.

make repairs or replacements if forced to do so.

Another New Passenger-carrying Record.—Louis Breguet, one of the leading French experimenters, broke all records for passenger-carrying on March 23rd by taking eleven people on a two-mile flat of the major of twelve as 1,315 pounds—an average of twelve as 1,315 pounds—an average of 109 pounds each—and that of the major of twelve as 1,287, making the total 2,602 pounds, or over one and one-quarter tons. This flight is especially noteworthy because M Breguet flew arcos country at a height of some 75 feet, thus demonstrating the possibilities of the across the control of the control pounds.

and traits and the establishment of fire lipinon—a total live load of 1.86% miles of trail were completed. It is recommended that the format and 15.000 miles of trail were completed. It is recommended that the format continue to be made. Weighloose communication. The principal causes of the miles of the miles of the state of the communication. The principal causes of the miles of the communication. The principal causes of the miles of the communication. The principal causes of the miles of the communication of the communication of the communication of the communication. The principal causes of the miles of the communication of the communication of the communication. The principal causes of the miles of the communication of the communi



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Electricity

Promoting the Use of Electricity in Germany.—A bureau for the utilization of electricity was recently was recently organized in Berlin by the German electrical industries. Its purpose is to encourage and extend the use of electricity in every way possible. The director is Mr. Binar Wikander The adverse of the bureau is Gerehâttsstelle für Blektricitäts Verwertung, Potsdamor Str. 68, Berlin W. 57.

Wireless Communication Between Mines,
—According to a press dispatch, Drs.
Leinbach and Loewy, two German scientists, have established an underground as system of communication. wheless system of communication. They have succeeded in sending messages a distance of nearly a mile and a half at a level of 1,600 feet below the surface, between the potash mines in the North Harz Mountains. The inventors of this system hope that their discovery may be of raine in saving life in case of mine distributions.

Complete Demagnetization.—Measrs. E. Gumlich and W. Grogowski, writing in the Elektrotechnische Zeitschrift, report their experiments in demagnetization in connection with a study of Pupin iton in connection with a study of Pupin coils They found that by using a demagnetizing alternating current, and reducing this steadily and with perfect uniformity, the smallest trace of magnetism could be removed. However, with commercial rheostats, such uniform reduction of current is impossible, but the experimenters have designed a special superatus by which this can be accomplished.

pillahed
Hydro-delectic Davelopment in the
South.—Mr. George Westinghouse rerently addressed the Southern Commercial Congress at Atlanta, Georgia,
and presented some very interesting statistics, pointing to the possibilities of
hydro-electric development in the Appsiach'an Mountains. He stated that durling the dry season of the year between
five million and seven million horsepower could be developed, and that this
power could be developed, and that this
tillier works, unline, steel mills, and
various factories now existing in the
South, and that by the use of electricity
the production in all these industries
would be considerably increased.

Whe Millegen in the Littled States.

Wire Mileage in the United State report of the American Tele Telegraph Company for last paone and relegraph Company for last var contains some very interesting sta-tiatics. There were 740,027 exchange sta-tions added during the year, making a total of 5,882,719, and 1,200,000 miles of wire were added to the lines, making a total mileage of 12,000,000. Some idea of total mileage of 12,000,000. Some idea of what this total means may be grassped when we calculate that this length of wire could be wrapped around the earth 500 times and that it would make 50 separate lines from the earth to the moon, but there would not be half enough were to reach from the earth to our nearest planetary neighbor. Yenus

Old-time Illumination.—In these days Old-time Illumination.—In these days of ingenious electric Illumination and display, it is anusing to read what the subjects of feorge II condifered a dazaling effect. A Frenhman, visiting Longold and the subject of rown, ading from the ceiling, each may ing thirty-six wax candles. On the king's appearance all suddenly lighted, and every one in the room was filled with astonishment at the wonderful and unexpected lliumination. Little cords white Sabeline Table Lamb of color wool, imperceptible to the eye, saturated with sulphur or saltpeter, a chair of different with the color wool, imperceptible to the eye, saturated with sulphur or saltpeter, a chair of different with the color with sulphur or saltpeter, a chair of different with the color with sulphur or saltpeter, a chair of different with the color with sulphur or saltpeter, a chair or with sulphur or was the color with the color with sulphur or saltpeter, a chair or with sulphur or was the color with sulphur or with sulphur or with sulphur or was the color with sulphur or with sulphur or with sulphur or was the color with sulphur or with s

Institute of the "Matthe "is Ribble." In Three Roof of the "Matthe "is Ribble." In driving the collections around the "Maine." In a rary seniorness have occurred certain portions of the wreck, the most noble of which was the 18-be roof of the forward turret. The force of the explosion was millelent to shear off the heavy boits by which it was held dwn, lift it into the air and throw it laterally some 80 feet from its original position. position.

position.

Progress at Panama.—The grand total of excavation at Panama to March lat was 131,889,436 cubic yards to be excavated. The total for February was 2,714,174 cubic yards. The concrete work advances apace. Fifty-five per cent of the total has been laid at the Gatun locks, over 60 per cent at the Pedro Miguel locks, and over 10 per cent for the locks at Miraflores.

Miratores.

Square-figued Ship With Oil Engines.

Great interest was aroused by the recent arrival in this port of the French
bark "Quevilly," which, with sails faried,
moved up New York Bay at a 6-inot gait
under her own engines. The "Quevilly" is a four-masted vessel of 3,372 gross
tons, which, after several years service,
had not the service of the service of

motors of 1,800 horse-power.

Public Health Promotion.—A department of public health has been established by the American Museum of Natural History, New York. Already there have been prepared a series of models it lustrating the pollution of New York harbor by sewage, and various methods for the proper disposal of this material. In addition to the models, there will be exadition to the models, there will be a addition to the models, there will be el-hibited charts and diagrams prepared by the Metropolitan Sewage Commission Later there will be an exhibit of wate supply sanitation.

Remarkable Railway Signal Efficiency.

The Hudson and Manhattan Railway —The Hudson and Manhattan Railway are to be congratulated on the great ex-cellence of their signal plant During January of this year, out of a total of 8,916,167 movements of signals, stops and switches, there were but four failures, which occurred with the automatic signals. There was not a single failure of the automatic stops, which made nearly those million recommends one of the signal signals. three million movements, nor of the in-terlocked switches, which made over half a million movements.

a million movements. Fina Lecometrie Recent.—A four-cylinder balanced compound Baldwin in-comoutive, which went into service on May 1st, 1906, on the Santa Fé Railway, remained continuously at work until October 22nd, 1910, when after making 2st, 128 miles, it was sent to the shop for the first general repairs. During this period not a single tube had to be removed from the boller, which was fed with treated water. Before the treating plants were put in, the tubes had to be removed after 30,000 or 40,000 miles of service.

Hillinois Eight-foot Waterway Approved.—The army engineers have reported in

Illinois Eight-toot Waterway Approved.—The army ontineers have reported in favor of building an eight-toot waterway from Chicago through the State of Illinois, at a cost of \$30,000,000, and they recommend that, if the looks and bridges cannot be completed within the limits of the \$20,000,000 as authorized by the State, the federal government afford the necessary financial assistance. The will be sufficient for present conditions, but that if the waterway is to be usage, by lake and ocean shipping, it must be given an ultimate depth of not less than \$4 feet.

Oll Fuel Recommend for the Navy.—

34 feet.

Oil Fuel Recommend for the Newy—
Charles A McAllister, Chief Engineer of the Revenue Cutter Searche, reports the results of a trial of oil fuel for three months in the revenue sutter "Golden Gate." A comparison of coal consumption for three months in 1910, compared with that of oil for three months in 1910, showe an earing of \$54.10. The coal of coal at 5x40 per four was \$195.64. that of oil at 0 to cease per gaillow was only of oil at 0 cease per gaillow was only only of the coal per coal of coal in the coal per coal of seaming with oil and only '48 cease with oil. The personnel, increoker, has been reduced from four to debes mer. This amounts anneally to a seving of \$847.



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American Tool Making and Interchangeable Manufacturing

By JOSEPH V. WOODWORTH. O.

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Cheese as Feed.—The Department of Agriculture has recently issued a bulle-tin in which the value of cheese as a food is sot forth. Tests with the reapira-tion calorimeter show that there is no very good reason for eschewing cheese as an article of diet, and that it is more di-gestible than most people suppose.

gestible than most people suppose.

The Mystery of the Mestry Dispelled.

—in a recent number of La Géographic.

M. Augustin Berard above that the Muluya does not meander, as most maps indicate, but that this famous Moroccan stream resembles the arrowy Rhom. The Muluya flows with a directness which may well be compared with that of a railroad line. Leady, it seems that the Muluya is not a natural fronter at all, as Frenchmen have long supposed. Save for its gorges it is a simple stream varying in depth from one to four feet with the season.

which many well be offer a with that of a railroad line. Leady, at the Muluya is not a natural frontier at all, as Frenchmen have long supposed. Save for its gorges it is a simple stream varying in depth from one to four feet with the season.

Marine Microbe Lamps.—In France, by the cultivation of luminous marine increose in a liquid medium contained in little glass vessels, there have been produced some of the most curious lamps produced some of the most curious lamps innatinable. If a few of these living lamps are arranged about a bust in a lamp are arranged about a bust in a lamp are arranged about the bust of it. The actinic power of the light light, and photographs may be shown of it. The actinic power of the light light of it. The actinic power of the light light so busined to render aprinted page easily legible.

Dew Water.—The ancient "dew ponds"

Dew Water.—The ancient "dew ponds"

Dew Water.—The ancient "dew ponds"

and the same

Dew Water.—The ancient "dew ponds" of England have their modern counterof England have their modern counter-parts on the Ruck of Gibraltar, where drinking-water is obtained by the con-densation of the abundant dew in espe-cially prepared basins. The primitive process consists in making a hollow in the ground, and filling the bottom with dry straw over which is placed a leave dry straw, over which is placed a layer of clay. On a clear night the clay cools very rapidly, and the dew is condensed into water in the basin. The pond is improved by putting a layer of asphalt Or Portland cement under the straw. At Gibraltar the present practice is to use wood instead of straw and sheet iron instead of clay.

Instead of clay.

Age of Fish,—Until within recent years there had been ascertained no trustworthy way of finding out the age of sish. It has been shown that mere size does not indicate the ace. Reblinch, Heinicke, and others have discovered that many of the bouse, scales and otolithe of fishes have annual age-rings, resembling those in trect-runks, and by means of these Wallace and others have determined the rate of growth of pialos, shown the control of the control it appears that the sexes have a differ

Artificial Furs.—A new process for producing artificial furs is described in La Nature. The raw pieces of pelt are frozen, and the skin carefully shaved off. rouen, and the skin carefully shawed off, thawed and sent to the tanneries to be made into leather. The frozen fur which remains is allowed to thaw slightly at the bottom, so that a small part of the hair is freed from ite. This thawed portion is then covered with a solution of rubber, which is allowed to set. The result is that large seamless than those who competitive the nearly than those who competitive the nearly skin. These same artificial rurs are said to be more leating than the real, because they are immune from the attacks of moths.

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FRANKLIN O. KING

The Tendency of the Times is More and More toward Centralization. Vast aggregations of Ureat Wealth have Assumed their Tendesce on most of Bo Natural Resources of our Country, and the chances of the Mayer-Tendency of the Mayer Sarrier of June 1999, and the chances of the Wage-Tender's in or gower Levenson York, By the "Wage-Tende" in mean the Man who Toolin by Hand or Heinin at a landy wager or no Mayer Mayer of the M

by the same Token, my Priend, I mean YOU YOU Chantor What no Nike Punes out of a Row's Bar," nor "Visither Figs from Thisties." Moreive Matters Will not Mend Them, and the Score You Open You Upon You Hopen You Hopen You Hopen You Will Hade Stope to Extring Conditions, the Quicker You Will Take Stope to Got Out of the But Into which You have Fallen.

and the same Dollar will

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April 1 Issue Scientific Assesses

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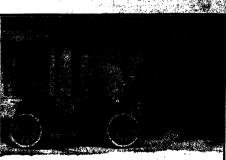
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By ALBERT A. HOPKINS, Editor of the Scientific American Reference Book

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Lighting and Heating

April Magazine Number of the Scientific American, Issue of April 15th

WE are going to tell you in the Scientific American something about these branches of engineering, what is being done and how it affects you in your home, in your office, in your business. A series of articles has been specially prepared by well-known authors who can write come a science in simple language. The subjects of this series have been selected not merely for the purpose of entertainment, but to provide information that will be of practical value to you.

lasteful Use of light

By Louis C. Tilliper

Light and Shadows By F. C. Com

amps of Today By Joseph B. Baker

Inventing the Light of the Fature By W. B. Kanneler



Lighting the

By Potson A. Be

Good Coal and

By Jeeph A. Holme

Heat from Dast By Chales L. Wrists

Heating the Home

All these articles will appear as an addition to the regular Scientific American. There will, for instance, be the usual Aviation page, the abstracts from current periodicals, the Inventor's Department, and many other interesting articles

MUNN & CO., Inc., Publishers, 361 Broadway, New York City

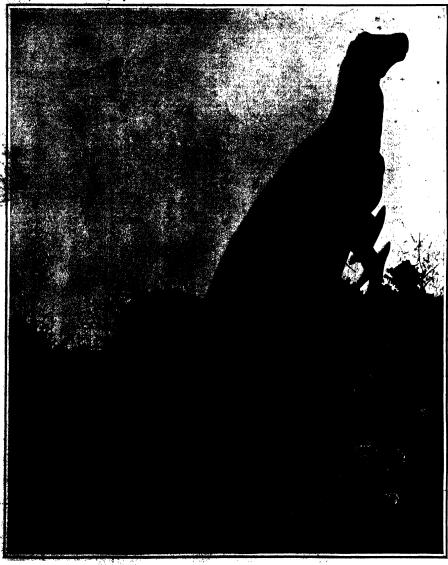
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

2000年代

NEW YORK, APRIL 8, 1911

10 CENTS A COPY



Equivalent This specimen towers treesty-live foot in the air, making the trees around look small.

A DECOMMENT THAT ROADERS THE RAKTH MELLIONS OF TRANS AGO.—[See page 322.]

SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, APRIL 8, 1911

ed by Munn & Co., Incorporated. Charles Allen Munn, Pr Frederick Cunvarus Banch, Secretary and Treasurer; all at 36 Broadway, New York

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The Scientific American Publications

Munn & Co., Inc., 361 Broadway, New York

The Editor is always giral to receive for ensumention illustrated articles on subjects of tunely interest. If the photographs are sharper the articles such and the facts authentic, the contributions relievely special attention. Accepted articles will be paid for at regular space rules.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientification. knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Sport for Sport's Sake

IHE presentation of the SCIENTIFIC AMERI-CAN Aviation Cup to Mr. Glenn H. Curtiss, as recorded elsewhere in this issue, gave the donors an opportunity to draw attention to the sportsmanlike spirit displayed by the winner in his persistent quest of this trophy. Although Curtiss is engaged in the manufacture and commercial exploitation of aeroplanes, and is therefore a professional, he has exemplified the best traditions of the amateur in his three-year quest of a trophy which brings no cash to the winner, and whose principal value lies in the distinction which it confers. The SCIENTIFIC AMERICAN has always deplored the fact that there was no competition for this trophy, and our regret was due, not so much to the consideration that we were its donors, as to the fact that the lack of interest in the cup proved that the spirit of coumer-cialism was dominant among the ranks of the avia-tors, not one of whom, outside of Curtiss, cared to turn momentarily aside from the hunt for large money prizes and make an effort to win a cup which has the distinction of being the first trophy of any kind offered in America in connection with the new art of aviation.

It is most unfortunate that not only here, but in Europe, the commercialization of the practical exponents of the sport seems to be complete. There has not been wanting evidence of a combination among the professional flyers for the purpose not only of securing the largest possible cash prizes at public meets-and in all conscience they would seem to be hig enough at the present figures—but of taking charge of the meets themselves and flying or not, just as the whim or convenience of the occasion

not, just as the winn or convenience of the occasion might happen to determine.

Let it be understood that we have no prejudice whatever against the professional airman. When he hangs his life in mid-air, upon a filmsy fabric of wood, canvas and wire, for the special delectation of an assembled multitude, it is perfectly proper that they should pay adequately for witnessing his game of chance with Death. Moreover, aeroplane sport is costly, and not many among the airmen have the private means to enable them to last very long at the game. What we do regret, however, is that in the midst of all this moncy-getting, one looks almost in vain for the relieving contrast of a touch of the true old sporting spirit; the spirit which in other lines of sport is cherished and guarded so assiduously by various amateur associations throughout the world. Now there can be no question that the undoubted popularity of the winner of the Scien-TIPIC AMERICAN Trophy is largely due to the conscious or unconscious recognition of the fact that scious or unconscious recognition of the fact that has in him, despite his professional standing, a strong das of the true sporting instinct; and we commend his successful quest of this truphy to the consideration of the younger lace of airmen, to whom we goest look for the rescuing of the sport from the rank professionalism into which it has fallen.

The state of the s

Fire Drills in Factories

HE only redceming feature of such a horrible catastrophe as the recent fire in a shirt-waist.

catastrophe as the recent fire in a shirt-waist.

factory in this city, in which nearly 160 geoplc, largely young girls not out of their 'teens, ware
killed, is the fact that it serves to stamp upon the c and official mind certain imminent dange which, but for such a frightful object lesson, would remain unnoticed and uncorrected. In the presence of such a horror, it is futile to moralize—the best we can do is to point out the practical lessons of the disaster and leave it to legislative authority to

the disaster and leave it to legislative authority to make sure, as far as possible, against its recurrence. Above everything, this fire has shown the need in all crowded factories of this character for the inatitation of a system of fire drills, similar to that which is practiced in our public schools. The na-jority of the unfortunates who lost their lives were young people of foreign parentage, and it needed only the occurrence of some sudden emergency such as an outbreak of fire to throw them into a state of as an outbreak of are to throw them into a state of uncontrollable panic. If the manufacturers who are engaged in making shirt-waists, feathers and flowers, and other goods of a highly inflammable character, are to be permitted to crowd the upper character, are to be permitted to crow due upper floors of buildings with machines and operatives, the law should make five drills compulsory, and the officials of our city should see to it that they are most strictly carried out.

Again, if, in crowded workrooms, it is inevitable that there will be a considerable accumulation of that there will be a considerance accumulation of the goods, either in a partially complete or a finished condition, it should be made compulsory for the landlord or the lessee to install an effective system of automatic sprinklers over the whole flor. In the case of the late fire, it seems that the flimsy goods were hung in rows above the operators' heads, and that as soon as the fire started, it ran through the stuff as though it was so much tinder. An efficient system of fire sprinklers would either have put out the conflagration or so far held it in check as to give the work people a reasonable time for escape.

the work people a reasonable time for cecape.

In this, as in every great fire disaster, involving
the destruction of large and panie-strickon crowds
of people, the question of adequate means of egress
is shown to be all important. Whether or not
such stairways and fire eacapes were provided as
the building law requires, the fact remains that they the building law requires, the race remarks were quite insufficient to deal with the emergency, cover broadly the needs of all buildings. What we mean is that the number of fire escapes and other means of egress should have strict reference to the uses to which the building is to be put. The fire escape capacity which is sufficient for an office buildis manifestly too small if it has to serve a ten ing is manifestly too small if it has to serve a ten-or twelve-story building whose various floors are teeming with the excitable and easily panic-stricken sons and daughters of the immigrant from central

Newspaper Science

RECENT press dispatch described the experiences of the passengers and crew of a A periences of the passengers and crew or transatlantic steamer who were treated to a display of that very commonplace phenomenon, St. tips of mests and spars appears to have caused about as much excitement on board as might have been expected from an appearance of our old and, of late, quiescent friend, the sea serpent. The capof late, quiescent friend, the sea scrpent. The cap-tain is reported to have studied the phenomenon at-tentively for some time, and at List to have given his opinion that it was a case of "St. Thomas's fire." Passing over the astonishing fact that an entire ship's company, in this year of grace 1911, where apparently quite unacquainted with a natural; phe-nomenon that has been the subject, itof daily of scientific research, but of the most banal literally allusion for at least two thousand years, and that crent het intelligent skipper could only recall vaguely that he had heard of something of the sort and that it was called after some saint or other, what shall it was called after some saint or other; what shall it was called after some saint or other, what shall we say of a newspaper that publishes an account of the crent as a marvelous accurence, and is obviously unable to give the phenomenon its correct name? Will not some philanthropist found a newspaper whose staff possesses just the radiments of a scientific deutstion? We other scientific many who permits himself to be inherered by the savenger? We other scientific accurately with or without his consent, are written up in the

daily press!

The mere terminology of every-day settings, appears to be an unknown tongue to the journalistic frateraity. In this respect, however, it may be some consolation to the persons to whom this griderium is addressed, to be tall that they are in the tinguished company. One of Manistratical's plays

contains the following their direction coddenic theorie grows the edg. Committee whether even the Coloque is lamouted memory, could have arranged.

A Change of Opening

VERYOUS who is familiar wist our scheme
knows that for many years past the fictionof the policy of building owner of the policy of building owner of the new wardings
in such government havy yards as are equipped to
this work. We believe, however, that conditions
have so far changed that, for the future, warning
building should be discontinued at the navy yards,
and all contracts for now construction should be
given to the secretary. given to the private yards.

given to the private yards. There is no inconsistency in this change of optoion, which is due entirely to altered expension, conditions, which, in our opinion, have not and successfully
awarded the arguments that we advaged a
dozen years ago in faror of building waithings at
government years.

In those days, when all new maral construction
was given to private building agents.

Sovermont yards. In these days, when all new naval despiration was given to private builders, costs were high and progress was very slow. We advocated the policy of lawting under construction at least one bettlenbip at a navy yard, on the ground that because of the inevitable rivalry which would be created between the private and the government yards, progress would be accelerated and there would be an inevitable refluction of costs. Moreover, formerly it was the custom, after the annual target practice, manocurves, etc., to send the whole facet, or the greater part of it, at once to the navy yards, crowding them with work and necessitating the employment of a large force of skilled labor. When the overhauling, refitting, etc., were completed, the facet would go to sea; there would be an immediate drop in navy yard activity; and a large portion of the force would have to be disbanded. It was considered that if a large government ship were on the the force would have to be disbanded. It was con-sidered that if a large government ship were on the stocks, it would be no longer necessary to disrupt the forces every year, the men being moved hover from repair work to new construction when the sleets invoved out of the yards for the summer cruising. The arguments advanced were plausible, and the recruits obtained justified the new departure. The "Louisiana," eister ship to the "Councetlent," (the first battleship to be bulk under the new plan), was bulk in record time, and set a new mark in contract

built in record time, and set a new mark in contract work, both as to speed of construction and cheap-ness of cost. To-day, ton for ton, we are building as quickly and as cheaply as the leading yards of Great Britain and Europe; and the government is getting its contract-built vessels at such a low figure that it is allogether impossible for our narry yards to make any successful competition. The movement for navy-built ships found its most powerful advocate among the corps of naval con-structors. Naturally, they are proud of the results accomplished, and because of their close identifica-tion with navy ward development, their swmasthies

accomplished, and because of fair close identifica-tion with navy yard development, their sympathies would naturally lead them to favor, if they could do so consistently, a continuance of the policy. The naval constructors, however, are now opposed to navy-built ships, and Chief Constructor Watt is or record as stating that the building of the 'New York' at the Brooklyn navy yard will involve an addi-tional outlay of over a million and a half dollars, above what she would cast if built by private con-tractors.

above what she would cast if built by private contractors.

Furthermore, the policy inaugurated under Scertary Meyer's administration, of composing our Atlantic fleet of divisions of fire, with one ship at a time of each division proceeding to the navy at time of each division proceeding to the navy distributing the repair work more evenly throughout the year, and making it possible to maintain a fairly chicispant ignor of workmen at the various yards.

Thus we see that the policy of navy-yard construction, admirable at the time it was instituted, and after having achieved its purpose, has now dealived its usefulness. Furthermore, because of the instituted of federal assistance in the upbuilding of our perchant maxine, our great shipbuilding establishments are all but starving for seant of work. Were it sattle wards construction, some of their would have be also their gates. This, in the event of a great instead way, would prove to be a positive calassity; for the yearths, oven by a victorious engagement, upon the material fuells, guing, pun motous, which is discussed way, would prove to be a positive calassity; would be seen in immediate call for the complexes of severy yard, public and private, that the counter definition of the provinces of the presence. It is due to construction of the presence of the

Nocturnal Warfare

An Automobile-mounted Searchlight for the French Army

By Frank C. Perkins

waternoon a constant of the care to find the waternoon the put to a variety of practical research. One of the most recent developments of this kind is a traveling searchlight carried upon an automobile, and designed for military use in the French gramy. The general aspect of this new piece of military.

mounted upon a truck and can be taken from the car and set up at any suitable point within a distance of 288 feet, this being the length of the fixible current leads from the lamp to the car. The searchlight may, of course, be operated in its position on the car, if desired, but as rule it is preferable to

from a contact breaker tuned in unison with the tuning fork. There are as many tuning forks as there are different movements, each tuning fork responding to a specific contact breaker

For field work glass reflectors are undesirable owing to their fragility. Silveted metal mirrors are

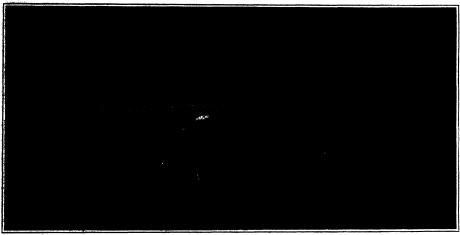


Fig. 1. - Automobile-mounted searchlight used in the French army.



Fig. 2.—View showing loading and unloading facilities.

THE SEARCHLIGHT IN WAR

tary segripment is shown in Rig. 1 of our illustration. The second figure above some of the detail features of the arrangement for leading and unloading the treats due carrying the searchlight. The car can be proposed by the carrying the searchlight. The car can be requised by the carrying the searchlight. The car can be requised to the carrying the searchlight in June 18 horse-parcel injector harring gaseline, alcohol or oil, and the side of the carrying the carrying

effect its manipulation from a distance, so as to avoid looking along the beam, and thus having a deep layer of brightly illuminated hase interposed between the eye and the object sighted, clouding the latter from view. In time-of war it may also be an advantage to be able to place the searchilight in a comparatively exposed position, and yet to operate it from under cover. The device employed for this manipulation from a distance is very ingenious; without going into a full description it may here be said that its operation is based on the response of a tuning fork at the scarchilight to a vibrating ourprate seat out.

unantistactory owing to the fact that they become tarnished under the influence of the electric are Of late gilded mirrors have been used with success. The brightness of the electric are may end a figure as high as 250 candle-power per square millimeter. By the way of comparison it may be mentioned that lime light gives at most only 8 and hower for the same area. The light comes almost entirely from the resultive carbon, and the two electrodes are placed accordingly, so as to give the best offers. With a reflector of 60 inches diameter knowl observations only be made at a distance of from two to three miles.

Presentation of the Scientific American Trophy

Speeches at the Aero Club of America's Banquet and Description of Cartiss's Work in Aviation

THE fifth annual banquet of the Aero Club of America, held the evening of March 20th, at the hotel St. Regis, in New York, was notable chiefy on account of the presentation of the Scinsvirio Atzai-can Trophy, which, as already told in our columns, was won by Glenn H. Curties for the third time in three successive years on May 29th last. In addition to this presentation, Brigadier-General James Allen made a speech in which he told what the War Department is trying to accomplish in aviation.

print below an abstract of the pre speech of Mr. Charles A. Munn, president of Munn & Co., Inc., donors of the trophy and publishers of the SCIENTIFIC AMERICAN, and part of that of Gen. Allen

PRESENTATION SPEECH.

"Mr. President, Mr. Toastmaster, and fellow members of the Aero Club.

"I feel sure that we all sincerely regret that it has not been possible for Mr. Curtiss to be present with us this evening and to receive in person the Sorm-TIFIC AMERICAN Trophy.

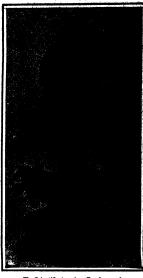
think that this trophy may be regarded as a of milestone. Incidentally, it was given by the donors with the object of fostering the art of aerial navigation. In view of the development which has taken place in the art during the past three years, this trophy may properly be regarded as a milestone which trophy may properly be regarded as a milestone which iss marked, year by year, the progress which has been achieved When we hear, day after day, of ex-tensive cross country flights of acroplanes carrying eight, ten and twelve passengers, and when we have seen acroplanes rise to a height of two miles above the surface of the earth, it is hard for us to realize that the minimum condition of competition for the trophy during the year 1908 was only one kilometer, or a little over half a mile straightaway Mr. Curtiss won the trophy for that year by covering this distance and a little more, making in all a flight of about one mile and a quarter

"During the next year the distance was, with a good deal of trepidation, increased to a minimum of 25 kilometers in a closed circuit Mr. Curtiss won the rophy for 1909 by covering this distance and making, all told, a flight of about 25 miles.

committee having charge of the arrangements decided to make the condition for 1910 a minimum flight of 50 miles across country. Upon the earnest solicitation, however, of a prominent official of the Aero Club, who had recently returned from Euro the minimum distance was reduced from 50 to 40

We all know how gallantly Mr Curtiss won the cup for the third time by his memorable flight down the Hudson River from Albany to New York. He

made the best long-distance record of the year in the first lap of this flight, by covering a distance of 7.1% miles, between Albany and Poughkeepsic. "We all have a feeling of endearment for the night



The Scientific American Trophy won by Claus H Curti

historic river which passes by our city. Three names will always remain associated with the history of the river-that of Hudson, the explorer: that of Robert Fulton, the introducer of river navigation; and that

of Glenn H. Curtiss, the hirdman.

"At the request of the president of the club I beg to call the attention of the members to the most

penerous offer of Mr. Mey'n Gould, of a \$15,000 for the most successful, acceptant with two or more motive acceptant in he takepandently or in mison. I regiret well must that Mr. Gould is not occupying the nost pro-lim at the other and of the table, as I dis-public recognition in due film for the unional only in offering this prise, which is dealer vent or minimise the fatal accidents which so prevalent of late.

so prevalent of late, "I believe that I am hetraying no confidence is saying that Mr. Ryan has been as late with the property of the saying that Mr. Ryan has been as late with the property of the saying that Mr. Ryan has been as the saying the saying for the continuent with the present south a say of the say of the continuent with a page of the otherwise of these plane will be given out later up. On behalf of the Arro Lyan of America, as sectorism of the tropic, I have the home to present to the property of the saying the

sion, and I feel sure that it will always be associated by the winner with that historic light down the Rudson River, and it will furthermore have a special interest as bring the first trophy over offered in this country for aerial navigation."

Mr. Augustus Pest, former secretary of the Asro

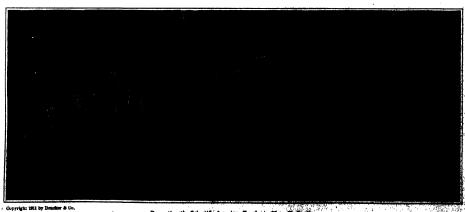
Club, and the club's representative in all the attempts of Mr. Curtiss, received the trophy for Mr. Curtiss and made a fine speech of acceptance in which he told how America's noted experiments had set out to win the cup at the start, and had kept constantly at work with this aim in view. How well he had succeeded, year after year, was told in a graphic way

GENERAL ALLENS SPERCH

Fellowing Mr. Post, Gen. Ailen, in a few well-chosen words, told what the War Department is doing, as

"This government has been accused of being slow to take up aviation as a part of the army service, but what is being done by the army suthorities is not understood, or perhaps not known. One of the substantial evidence of the interest is the fact that the aeroplane is now in use on the Maxican border by the troops mobilized there, and is of nusual value in that part of the country because of the difficulty of travel.

"Only a few days ago one of our men went up in a machine and covered 186 miles in about two hours—a distance which it took two or three days to cover by wagon at one time. And he saw more of the country wagon at one time. And is aw how to the occurry in those two hours than any of us had seen in years before. The army is now establishing an aviation course in Washington, along the east side of the Petomac River, and there it is the intention to let those



the aviation conrect have all the practice re-sis or lik them for marial think. Another aviation has been established at Fort Leavenworth, and at sther player throughout the country for sim-

tures receiving close attention is the pment of flying machines from the view-of stability and safety. The government perms of standing and savery. The graphs has about \$100,000 to spend for ma-sides, and will put it into the different types. As more money is appropriated the field will be extended.

"It is the ultimate intention, I believe, h aviation to several thousand army men, who will be ready at any time to go aloft in their machines during the mobilisation of troops, no matter for what purpose, and it is believed that they will be an extraordinary adjunct to the efficiency of the army as a whole.

it it is of great importance to the publie to know that while the aviation grounds of the government will be primarily for army men, they will be open to the general public as well, so that any person having a flying machine can use it in these places freely and also get the benefit of the instruc treesy and also get the beneat of the instruc-tion of experts in flying. Their opportuni-ties will be as great as those afforded to army men in the matter of study and

CURTISS'S CAREER AND EXPERIMENTS

Glenn H. Curtiss, the man who has done so much toward the scientific advance-ment and the practical development of aviation, was born in Hammondsport, N. T., on the shore of Lake Keuks, on May \$1st, 1878, When a boy he delivered newspapers in his home town and worked later enger boy for one of the telegr companies in Rochester, N. Y. Returning home, he established a newspaper route, and while delivering papers to his scattered cusrs became interested in self-pr vehicles. Before he was twenty, Curtiss had built a motorcycle to carry him over his route. This machine was developed into a ommercial product, young Curtise paying the expense of his experiments by doing bicycle repairing and electrical work. The embryo motorcycle manufacturer also took up the motorcycle sport, winning many contests, including the American championship. Aiming for the speed championship of the world, he built a special machine, and in 1907 at Ormond Beach, Florida, he is said to have covered a measured mile in 2625 seconds, which, if correct, stands as the fastest mile ever traveled by man.

From motorcycles to aeroplanes proved a short step. The lack of a suitable motor had been the greatest obstacle in the way of air bavigation. Curtiss developed his small engine for use in dirigible balloons with successful results, and was soon supplying successful results, and was soon supplying the power plants of practically every suc-cessful dirigible in America, including the sirghip sold to the United States Army by

Invited by Dr. Alexander Graham Bell to e a member of the Aerial Experiment Association, Curtiss was made director of experiments, and in this capacity designed his first heavier-than air machine, the "June Bug." With the "June Bug" Curtiss won the first aviation prise offered in Americathe SCIENTIFIC AMERICAN Trophythe SCHRYFFIC AMERICAN TYOPNY—DY NYING as mile and a haif on July 4th, 1908. He made a number of flights prior to this, using other machines built under his direction by

While teaching members of the Aeromantical Society to My in Mincoln M. I., in the spring of 1909, Curties was urged by the Acto Chife of America to represent this coun-try in the first interestional rect. With an attendance that had never been assembled until after he arrived on the field at Rheims. defeated Bieriot and other leaddge aviators, becoming the first in-mal champion. After Rheims, Curties pered among the world's greatest at Breacts, Italy, he duplicated at Rheims, and since then his in America flave neen indelibly upon the minds of the pen-

in Hight down the Station River from

Albany, N. Y., to New York city on May 29th, 1910-150 miles in 152 minutes-will go down in history. By covering the first half of this distance-711/2 miles hour and 23 minutes, or at the rate of 51% miles an Curtiss won the SCIENTIFIC AMERICAN for the third and last time, and secured final possession of the cup. This is but one of the many triumphs he has accomplished, almost any one of which would



an H. Curties at the wheel of his bipl



Three-quarter rear view of the Curties military biplane.



Curtiss biplane mounted on a float and wheels



re rising into the air



This picture shows very well the small size of float, THE CURTISS MILITARY BIPLANE AND SOME OF HIS EXPERIMENTAL MACRINES

bave been sufficient to win him enduring fame. Among the most notable of those following the Hudson flight might be mentioned his "Fifty miles over the sea" flight at Atlantic City. N. J., in July, 1910; his trip over Lake Eric from Euclid Beach to Cedar Point, -64 miles-and return the following September. and his more recent flights from the surface of the water in the new machine developed by him, which

alights on and flies from land or water

Aviation for military purposes has been given its greatest impetus by the experiments made by Curtiss or conducted under his direction, such as bomb dropping, target shooting, sending wireless from an aero plane in flight, as well as the flights of plane in night, as well as the nights of Eugene Ely from the decks of two of Uncle Sam's battleships, upon one of which he successfully alighted. In furtherance of the military idea, Curtiss also volunteered to instruct aviators for the army and navy, and has graduated three army and one navy officer from his school at San Diego, Cal.

without a cent's cost to the government During the past winter Mr Curties has been experimenting at San Diego, with a view to perfecting a suitable float for start-ing from and alighting upon the water. He had already tried experiments in this direction a number of years ago upon the lake at his home at Hammondsport, N. Y., and profiting by the experiments of M. Fabre in France, he was not long in making similar floats with which he was able, on February lst, to rise from the water with his biplane He afterward simplified the floats to a sin gie long, narrow, scow-shaped pontoon, which worked better than the hydroplane floats used at first. He found experimenting on the water was preferable to experichanges such as placing the motor in front and the aviator's seat behind the main planes, and adding a third surface above the biplane, thus converting it into a triplane One of the most interesting feats he is said to have performed was flying with but one alleron, or balancing plane, on his machine In view of the patent llugation he has had with the Wright brothers, this should prove valuable in behalf of Mr Circina's defense. Finally, after all these other experiments,

Curtiss early last month fitted wheels to his biplane in addition to the float, and rose from the water or from the land and alighted upon either at will One of our photographs shows his machine coming out of the water and running up on the shore. Thus he succeeded in perfecting the machine so that it is now a true mechanical water fowl.

Only a couple of weeks ago, after having

instructed four officers of the army and navy in flying at San Diego, Curtiss delivered to the War Department at Washington his first military biplane, a photograph of which is also reproduced on this page machine has several new points of interest, such as the placing of the allerons at the rear of the machine instead of at the front, and the tail, the movable rear ends of the two triangular surfaces of which act in conjunction with the front rudder to steer the machine in a vertical plane. This biplane is very strongly built, and is canable of carrying two men and 300 pounds extra weight It has a spread of 32 feet, an over-all length of 29 feet, and its total supporting surface is 320 square feet; the weight complete is 700 pounds. In making the acceptance flight Mr McCurdy made two magnificent flights of 10 and 8 minutes' duration above the Potomac at Washington The machine has been sent to San Antonio, Texas, where the officers will experiment with it Curtiss himself will come East the middle of this month, and will conduct further ex-periments in the neighborhood of An napolis. In all probability he will devote much of his time in the near future to perfecting the acroplane for naval use

Copal varnish (according to Heeren),-Dissolve 60 parts of West Indian copal in 60 parts of highest per cent spirits, 10 parts ether, 40 parts oil of turpentine, by gently heating. This succeeds only with the varieties of copal that in the above named solvents are not merely softened but actually dissolved—the copal must therefore be tested first as to its solubility.

Old Coins and Ancient Bankers

The Origin of Our Modern Methods of Commerce

By Walter H. Woodward

T is to Lydia that Europe owes the invention of coinage In all times and in all countries, the privilege of coining has been allowed the sover of Lydia, was the first monarch to introduce a bimetallic system of coinage gold and silver in the proportion of about three to four. This was some between 560 and 546 B. C. Darius, of Persia, is said to have later adopted this idea also.

t a very early age the ancients found it ne to discover some definite medium of exchange to take the place of the inconvenient method of barteris the most primitive means of carrying on trade Metal was chosen doubtless by reason of its durability, and in the case of gold and silver, by reason of their in-Silver and brass were first used, partrinsic value ficularly in Greece, from a lack of sufficient gold. Later, however, this deficiency was overcome in a manner to be described farther on The less liable a metal is to change in value, the

better it is suited for a standard.

The first method of using precious metal as a medium of exchange was impracticable and inconvenient it was simply weighed and exchanged, in r commodities of various sorts. Soon, as commercial transactions increased and became more complicated, it was found necessary to divide the mass into units of various weights, which took the form of rough coins To this day there is one surviving relic (in name only) of this first system of payment weight. It is the word pound. This division proved unsatisfactory also, since no two merchants were likely to have split their store of silver into pieces of equal weight. Their units could not be taken as a standard, since a piece of weighed metal becomes a coin only when it is stamped by the State and is thus guaranteed to have its professed weight and purity

The Greeks first issued real coin some time during the seventh century B C. By the fourth century the entire civilized world used money. It is supposed that the priests played an important part in the introduction of money, for it is highly characteristic of them that their coins were from the start marked by religious association So ancient coins in a great measconfirm history and have been, and in the years of discovery yet to come will doubtless continue to the greatest help to historians.

In addition to illustrating events of history, the ns have also a direct and valuable bearing on the religious beliefs of the nations and tribes by which they were issued The mythology of the Greeks has not been recorded by them in sacred books to any stent, nor handed down to later generations by a faithful and studious priesthood. Their mythology ran on unchecked, and having grown out of the beliefs of scores of various tribes, reaches us in a condition which scarcely admits of sytematizing. Greek coins up to the death of Alexander beer only Every coin issued bears a reference sacred subjects. to some delty. Coins of Miletus, for instance, bear a lion; those of Eretria shows a cow and sucking calf; those of Cysicus show a tunny-fish, etc. All these were symbols of the goddesses. The coins issued under the empire bear, as a rule, the imperial portrait on one side, and on the other a sacred emblem.

The whole, then, affords us invaluable assistance in

reconstructing Greek mythology.

Ancient coins are of simpst equal value to the geographer as to the historian.

Then too the art of sculpture, of which coin engraving is an offspring, receives great illustration from a The memory of lost statues is preserved for us, and, particularly in the case of the Greek coins, we are afforded an example of that skill by which her sculptors attained such

The history of Greece is one of a people continually torn by civil dissension. Their story is one of war and strife, forever between themselves, and in later years with outsiders. War is an expensive thing in more senses than one, though we have need to take note here of pecuniary costs sione. As the various States were jealous and always at odds, so were men, and as a consequence the religious temple we sorted to as a depository for the safekeeping of precious metals and jewels. These religious institut played no unimportant part in the development of earlier Greek commerce. They held vast sums of gold plate, and this, together with fortunes of their own, derived from votive offerings, they employed productively for their own use. They loaned money at a high rate of interest, and this custom very likely suggested to others the idea of doing likewise. Pasion was probably the first to do this. He founded a house at Athens, operating with a capital of fifty talents He established for himself first-rate credit at all cen ters of Greek commerce. In this way business could be transacted by the exchange of a sort of letter of credit in place of payment in coin.

credit in piace or payment in coin.

The introduction of this system despite its small scale shows the growth of commercial activity.

Money was now more plentiful, and all prices higher than ever before. This was due is a measure to the amount of precious metals, chiefly gold, which had been brought into circulation. War upon war is the gradual coinage of the treasures which had for years been accumulating in the temples, and this new "banking" system put on the market money which would otherwise have been hoarded. The interest rate was high. Twelve per cent was paid for the loan of money. This fact is significant. It shows the thriving condition of industries. Capital was evidently in demand. With a fortune of fifty talents (less than \$50,000) there would be yielded an income of \$6,000. That sum of course then possessed far greater purchasing power than does an equivalent

It might be well to say a word here concerning the origin of the term bank. Some authorities have it that its origin is found in the Itsilan word beaco, a money changers in the market pl I am inclined, however, to favor the claim of other authorities, who maintain that the term takes its origin from the old German word Banck—a pile. ind, heap, as of precious material

Greek bankers (trapesity) maintained their stands in the Agora, and combined in their vocation a number of other businesses. They changed money, bought foreign money at discount, furnished gold for export, foreign money at discount, furnished gold fo loaned money to merchants on security of ships and

their cargoos, and received sums on deposit for which they paid interest. They later on often estad as pawabrokers, accepting gold plate and jewala, and other personal property.

We have no evidence that any of these ancient banks and hankers were ever guaranteed by the State, and very likely they were not. One exception may have existed, however, if we are to credit Aristotte, in the case of Bysantfum.

In Rome, bankers are known to have existed as

early as 309 B. C., their functions being practically identical with those of Greece. We have a triffs more reliable information concerning these Roman bankers than we have of the Grecian. Their various branches of doing business seem to have been as

Their Permutatio, or exchange of foreign coin for binan currency. For this they charged a commission or exchange. Subsequently, when the Romans acquainted themselves with the Greek method of bills of exchange, they received money which was to be pasti at Athens, for instance, and drew a draft of exchange upon some Athenian banker with whom

Their Depositum, or keeping of sums of money for other persons. Cash might be deposited merely for safekeeping, in which case the banker (Argentarium) paid no interest. When a payment was to be made, the owner was required to draw a check, as in mod-ern times. But the deposit might have been made upon the stipulation that interest be paid, in which event the transaction was called Oreditum. The banker could then employ this money in his own in-

in the event of failure of a bank, the law enected that the claims of the depositorii should be satisfied before those of creditors who had money deposited to their credit at interest. The Argentarii never delivered money to anyone except upon receipt of a check, and the payment was made in cash, or if the person who received it kept an account with the same banker, the sum was credited to his account.
Of all receipts and expenditures these bankers kept

an accurate account in books called Codices, and have every reason to believe that they were familiar with double entry bookkeeping. Thus the Argenteric carried on a business almost identical with that of the modern bank. They combined with their regular banking business other avocations of a kindred nature. They often acted as agents at private sales and auctions. They acted as brokers, too, in the modern mse, and frequently undertook to sell entire estate

For many years the ancients maintained that charg ing interest partook of the nature of usury, and mer of this profession did not enjoy the very highest reputation. After a time, though not escaping re-proach, the higher class of bankers maintained a od name and enjoyed a reputation for honesty and ability. Their credit in all parts of the commercial world enabled them to raise on short notice large sums of money in foreign cities. Much confidence was finally placed in them, business often being trans-acted without witnesses, so they became in time a sort of unofficial notaries public.

The Le Verrier Centenary

E VERRIER was born on March 11th, 1811, at St Lo, in the Department of La Manche, France This is the year, therefore, in which the entire scientific world celebrates the centenary of his birth. Undoubtedly he was one of the greatest mathematicians lived College undergraduates who fail in mathematics may find some consolation in the fact that despite his special aptitude, he failed to pass his examination at the Polytechnic in 1830. After graduating he was about to become assistant to Gay-Lussac, when he was offered the assistant professorahip of istronomy at the Polytechnic School, which post he accepted. Thus he was fairly launched on an astro nomical career remarkable for its brilliancy. His le Mecanique Celeste," and was published in 1839

Le Verrier, of course, is best known for his mathenatical discovery of Neghene, Not only was a new planet added to the solar system, but the immensity of stellar distances was driven home. It was on August 31st, 1846, that Le Verrjer announced to the Academy of Sciences the theoretical position of a planet which caused the perturbations of Uranus, perturbations which were first discussed by the F astronomer Bouvard, and which for two decades and more were a source of much mathematical comment among astronomers. A few weeks after the announceof the Academy of Sciences, Galle, in compite with Le Verrier's request, directed his telescope to that portion of the sky indicated by Le Verrier, and found the star which we now call Neptune.

This brilliant success inspired Le Verrier to investigate the movements of every planet from the first to the last, from Mercury to Neptune, an immense labor, which completely shattered his health. He died on September 23rd, 1877.

The Current Supple

THE opening article of the current floresimpley. No. 1840, describes two new breakwaters out the west coast of Jutiand—Technical chemistry has contributed a very important share in the successful development of aerial navigation. What chemistry has

dene for ballooning, for example, is well told by Mr. A. Sander, in an article entitled "The Preparation of Gas for Balloesa."—The effect of padius on the higher animals is discussed in the light of Prot I.... Gas for Ballocen."—The effect or spanus on use higher annias is discussed in the light of Froi. Lon-don's researches.—One of the most important articles in the currelat Surpusants; is Mr. Watter V. Turner's paper entitled "The Air Brake as Related to Progress in Locomotion."—The question of efficiency and common in the management of industrial enterprises. communy in the management of industrial enterprises, ma revealed by Mr. Harringian Smorrown, is presented in a summary of the paper read by Mr. Emerson here Harrard University—Mr. W. C. Phalan's space on "Potant Scitis" in concluded—Some triansating new Presch tory of a mechanical nature are described and Himsteried—Mr. S. S. Hough discourses on the along

The Loss of Oil Entailed by Burning Wells

A COORDING to the American Machinets, it dans about assumably more than a million and a half duried of oil by the numing of oil wells.

What do You Think of the Scientific American?

Some Answers to a Question which We Put to Our Readers a Few Weeks Ago

rgi HF fell-page adverticement which we published, in it shick as feetled our readers to appress themselves freedily about the Suzzazzaz Azamacax, had brought forth as retrahelming response. Bons of the litters have been highly subglished; comes have indicated the sery proper and the service of the service of the service been serviced the service of service of the service of the service of service s

make the SCENTRIM ANERGOAN on even more popular weekly than it was before. The following latters are selected and published largely for the purpose of stimulating more replies.

The purpose proper is to take the same personal interest in the SCENTRIM ANERGOAN that he choked in it himself. After all, it is your paper as much as his. You

I would like to visit the editor. I invite him to con

a would like to visit the editor. I invite him to come and visit us real often.

I write for the agricultural press, and other publications; am an amatear student of plants, infix, animais, geology, and sus an Asdubon follower. Perhaps a column in the Senserrac Assucace on mercy to animals would be a missionary for good.

Alexandria, Mo. Japza Bizirza.

Que-third Better

To the Editor of the SCHWIFTE AMERICAN:
In response to your aiticle in the SCHWIFTE AMERICAN
to your subscribers, as to how they liked the way the
SCHWIFTE AMERICAN is conducted, I wish to say that it

SCHEFURG AMERICAY is conducted, I wish to say that it is conducted spelendidly.

Your weekly articles on aviation are very instructive. Your monthly magazine numbers are a great improvement over the old Schefurge America. Your new department "Science in the Current Periodicals" is a very valuable addition. The removing of the patent list, and putting reading matter in that space, was very wise, for the reading matter, in It think, more valuable than the natural list. patent list

J may say in a few words that I think the new Scien-educa American is at least one-third more valuable and instructive than before the present change. Frederick, Md. ALPRIN G. ZIMMERMAN.

Mr. Spears Wants Medicine

To the Editor of the SCIENTIFIC AMERICAN:

DIT. SPORTS WHILE ASSESSED AND ASSESSED ASSESSED

SCHEMIZE AMBRICAN was a mere reference, and by comparison very disappointing.

You will say, perhaps, that the magazines exaggerated the story, and that much work is yet to be done with the remedy before it can be classed as a scientific achievement, foranting this, may! not suggest that all the steps made in developing such a thing, including the mistaker mate, are, or ought to be, of the very greatest interest to every intelligent reader?

are, or ought to be, of the very greatest interest to every intelligent reader?

Let me emphasise the assertion that such work ought to be of intense interest. That many people do lack interest is an astounding fact. Why, we are in a state of divilisation where our Congress devotes nearly two hundred and fifty millions a year to the development of the stat of taking human life, and leaves such research work as is done at the Rockefelier Institute to be supported when the supplier of the supplier of the supported that the supplier of the

dollars!
It is clear that even intelligent people are chiefly
interested in reading the stories that tell how some one
has made, or is to make, some discovery by which he will
grow two bands of grass where he gree but one before.
The production of grass is our test of interesting pro-

great.

I concede that if you will, newspaper featon, give pepte only what the majority want, you will omit most of the accounts of advances in medicine. But I beg you to remember that your work is educational to an extent not nejoyed by many, and that the appetite for what we road grows with amount of masterial audituities. We

pay for it, and you have a right to tell him whether or pay for it, and you have a right to tell him whether on not you are getting what you expect out of its pages. If you have not aiready communicated with the Editor, do so. Tell him whether on toy you agree with the read-ers whose letters appear on this page; tell him just what the KUNNTUR AMERICAN meass to you, where it helps you, and where it fails to help you.

strove to grasp the Fourth Dimension when you gave space to it, and in like manner reading about Rensely 600 (or call it Rensely 107, which it may be when at lest it is the perfect thing) will create a vorking, forewarding interest in the struggle with what seems move to be unconquerable diseases. For the sake of those who now stand belpies beside this lesd of the dying join, by the method I have suggested, in the work of the few who are trainer to risk one or civilitation to be fined when the setting to risk one civilitation to be fined when the setting to risk one civilitation to be fined when the setting to risk one civilitation to be fined when the setting to risk one civilitation to be fined when the setting to risk one civilitation to be fined when the setting to risk one civilitation to be fined when the setting to risk one civilitation to be fined when the setting the risk of the setting the risk of the risk method I have suggested, in the work of the few who are repling to raise our civilization to a level where the arts of healing will have at least as much consideration as the arts of destroying human life. Northwood, N. Y.

[Author of "The History of Our Navy from Its Origin to the Present Day."]

A Clergyman Approves

To the Editor of the Scientific Americani
Apropos of your invitation in the Scientific American
for the friends of the paper to make such kindly suggestions as they may wish, I venture to suggest one or two

tions as they may wish, I venture to suggest one or two thoughts.

First. I wish to most heartily indoorse the policy and auccessful handling of the material you give us from week to week—especially sure you have enlarged and changed to week—especially sure you have enlarged and changed tw plans. It is most helpful, and it gives me pilksure every few days to reier to its value, etc.

Second. While I do not feet that the management has materially erred in any cosential, till it does appeal to meet that there are oversomably articles that might be met that there are oversomably articles that might be place in so good a paper to do not obtain a place in so good a paper.

I do not not successful the place in so good a paper to the publication, if they readly fill a place for someone else, as I do feel that I would like to see mure along the other lines. other lines

Third. I most heartily approve of the idea of placing the patent matter in the Sepplement. Pourth. While I am a layman in science, I feel a gen-

eral interest in everything of a scientific nature, and ap-preciate the generous space allowed to the several topics and sciences. Ove us also more short scientific items and preciate the generous space allowed to the several topics and sciences. Give us also more short scientific items and new notes, such as you give us one column of under "Science."

"Science," It want to most heartily approve of the most prifth. I want to most heartily approve from the generous amount of space given to astronomy. You have given such a liberal amount of space to this science, that no one has any right to say that it is not receiving proper recognition. The monthly notes and map are letter than I have seen in any amateur astronomical journal. At my Chautaquane, where I lecture and conduct classes in as-Chattaungas, where I between an inning are setter than the control of the control

From an Electrical Contractor

To the Bellior of the Serverine, Avancases.

To the Bellior of the Serverine, Avancases.

In reply to your editorial of March IIIth, would say that
I have been a reader of the Senverine Avancase since
1895, and unhesitatingly state that I have received great
knowledge from its contents. In my estimation, the weekby patent issue should be published, its many illustrations
giving new ideas to the thinker.

Mt. Carmel, III,

Patt. M. JANKE,

Rinstriand Contraction.

Electrical Contractor.

From Brazil

To the Editor of the Schwerze American:
Allow me to congratulate you on the appearance of
the greater Schwerze America. A beautiful number—
in typography, congravings, and matter. I hope your
effort to better the already good, will meet with a gencom recompense. Guarapuava, Parana, Brasil.

Rav. J. B. Kola.

A Word of Appreciation

A Word of Appreciation

To the Editor of the Schustpuro Assument,
I am very much pleased to note that our valcome
Thursday vision, the Schustpuro Assument, has been increased to twenty-four pages; also to note the handmose anti-month numbers, which are, as usual, brimming
full of interest. This adds another large step to the
great apprintity your magasine has over any other maganine published says-have in the world.

The published says-have in the world.

I don't think there has been a single week when the
Schustpuro Assument and interest polythering to our illurary
table. It is the most comprehensive, at the same time
inpearies and vision if the published to-day. It is the concrete exprecision of the world's progress in that most interesting pression of the world's progress in that most interfield, science.

name, actenace. We have always felt this way about the Schemerro American, and as this is the first time I have had oc-casion to address you, I take pleasure in saying it for our whole family.

One Interested in Static Electricity

To the Editor of the SCENTURO AMERICAN.
Your well-meant liquity as to taste of your subscribers in articles most favored called my attention. I personally an very much interested in the study of atmospheric, magnetic, and state electric effects of this planet in first place, and then its, or their mutual effects in the solar system.

Very respectfully yours,
Minas Nuevas, Mexico, C. R. Mayan

No Interest in Astronomy

To the Editor of the Sensymon Assertance Assertance I I will have to confess that I do not care for the sub-ject of astronomy at all. I know it is a wonderful study, but it has no charms for me. I have nothing to say about dropping the patent list from the Subramaray, for I do not take that paper. Pittsburg, Kans.

JAMES TOMIZESON.

More Archaeology and Anthropology Wanted

More Archaeology and Anthropology Wanted
To the Editor of the Schutturio American.

I have been a reader of the Schutturio American.

I have been a reader of the Schutturio American.

I have been a reader of the Schutturio American.

I have been a reader of the Schutturio American.

I have been a reader of the Schutturio American.

I have been a reader of the Schutturio American.

I have been a reader of the Management of schuttile the order of schuttile the order of schuttile the continually making immense advances, with which it is a continually making immense advances, with which it is continually making immense of the more purely technical matters could be confined to the Schutturian, and transporting the necessaries and humanes of our physical life.

Some Helpful Suggestions.

Some Helpful Sugmentions.

To the Ritter of the Summers Summers.

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Diplodocus -- the giant of saurians, measuring some sixty-six feet in length.

AT Mr Carl Hagenbecks famous animal park at A Stellingen near Hamburg there have been creeted life-size representations of the great monaters that inhabited this earth millions of years ago The idea of the proprietor in building these strange beasts is to present to the public view a faithful and accurate picture so far as science can tell of the world creatures that roamed over this globe in the distant past

The work has been carried out by Mr J Pallen berg a well known German animal sculptor Theo strange beasts of the past have been built up of coment and rightly occupy a portion of the grounds to themselves in all some thirty have been constructed around the shores of a delightful little lake some three acres in extent The animals are depicted standing by the waters edge amid the shrube and

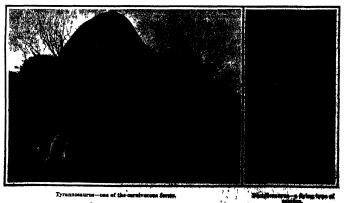
trees while in the lake itself are shown huge erox oddles and other aquatic types Addition al realism has been chained by resunting a few of the ari mins in the act of bat ting with specimens of their kind.

mal to be erect
cd was the igu
anodon a great
herbivorous din
aur That this
creature habitu
ally walked on
its hind legs has
been proved beyond doubt by
tracks found in
various parts of
Europe In the
year 1888 no few
er than twenty
five specimens of

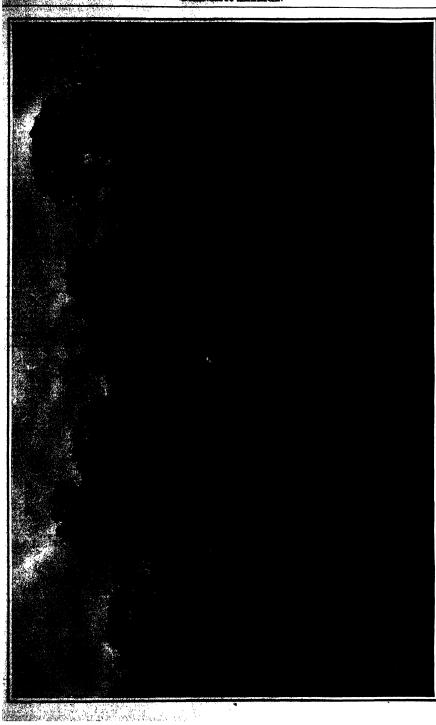
this huge creature were brought to light from the collitery of Bernissart in Belgium a discovery quite unique in its kind Every bone of the creatures skeleton has now been cast in plaster of Paris so that duplicate can be supplied to museums. This dinceaur had a most remarkable dagger like thumb so bly and pointed in shape that at one time when discovered by itself in England it was considered to be the iguandons horn Some popular works on geology still continue to reproduce an olf restoration with this strangs born on the creatures nose! The specimen in coment at Stellingon towers some twenty fave feet into the air making the trees around look rather small. The thumb of the monster measures some eighteen inches in length

In the construction of these restorations every care has been taken to render them accurate. Before the sculptor commenced operations at the gardens he spent twelve months in preparatory work. He visited all the leading mueeums in Europe, consulted with leading naturalists and made extensive drawings and statches of the bones which have been brought to light by the fossil hunter. He admitted to me that he had obtained a great dead of help from the authorities of the American Museum of Naturel History in New York who supplied him with valuable photographs and drawings as well as measurements I noticed in his office, too, copies of the Scurryric Akamicax con taining articles and illustrations on the subject Berew work was extually commended in the park models were built in clay, casts taken of them and these were submitted to leading authorities for opinion When it was found that they differed the models were remade and submitted again until they met with

the desired approval There are several representations of the din colored at the several representations of the din colored at the several representation of the din colored at the several representation of the din colored at the several representation of the several represent



RESTORATIONS OF PRESENTANC AMBLES



Triceratops-One of the most fantastic forms that have come down to us in the fossil records of the earth's history.

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Flome and Abroad

Scientific Sericulture

THE rearing of silkworms was at one time an important source of wealth in many districts of southern France, but the industry has been almost destroyed by the ravages of parasitic diseases, and only a few small and not very flourishing establishments are now in existence.

view of the fact that efficacious methods of checking the scourge have been developed from the memorable researches of Pasteur, the decadence of French sericulture is very remarkable, especially as French silk manufacturers are still very prosperous and cocoons are imported in large quantities from the European countries. Freuch silkworms are not peculiarly susceptible to disease. The supertority of the foreign silk culturists is due solely to their more intelligent practice of the scientific methods of sericulture which were developed in France by French scientists. It is not sufficient to give the silkworm breeder a microscope and show him how to use it In order to follow Pasteur's method intelligently and apply it to every detail of prac-tice, it is neces-

sary to create an organization for the direction and control of the varions operations of sericulture The imtails and s ary questions nore effectively than by describ the only one of its kind in the world, which private initiative, aided by public funds, has cre ated in the Aus trian Tyrol, where sericulture is now in verv flourishing condition. The description which follows is adapted from a recent is-

> 1882 the

Bacological Insti-

tute of Trent was founded by a provincial agricultural society for the purpose of making Tyrolese silk culturists independent of imported "seed," or silkworm eggs, improving native breeds, giving technical instruction and teach-ing good methods of sericulture Since 1894 the institute has occupied buildings specially constructed for its use with the aid of funds contributed by the so-ciety and the municipal and general governments, but these buildings are now inadequate, and new ones contemplated.

The work of the institute is of three kinds. The production of sound eggs of good breeds of silkworms, technical instruction, and experiments in selection and in methods of sericulture Of these three funcand in methods of sericulture. Or these three lunc-tions the production of eggs is by far the most imecause of the care required and the large number of eggs which the institute furnishes to silk About 25,000 ounces of eggs are through the winter in cold storage in a current of dry air. In April the eggs are shipped to domestic and foreign purchasers, to whom they are sold for about foreign pureasers, to woom they are soid for about one third of the market price of inferior eggs, as the institute is operated with economy and seeks no profit. Each ounce of eggs yields about 160 pounds of coccoms of very high quality. Some of the eggs are retained for dis'ribution among 600 breeding st are retained for distribution among 600 breeding sta-tions scattered through the district, so that each warlety of sithworm finds the conditions most favor-able for its development. These stations are sup-plied with everything required for new methods of culture which have been taking up, the institute, as well as for the routing statict and the in the Tyrol. The accompanying Musician are different arrange.

ents of twigs on which the silkworms of ments or twigs on wagon the siltwords of the variety of methods employed. These stations are directly for methods employed. These stations are directly former pupils of the institute, and they forms escendary conters of instructions. The stations are very shown constul, as the institute pays high prices for con-produced by approved methods.

When the coccoons are received at the institute the female cocoons, which are heavier, are separated from the males, and all cocoons of abnormal appearance are rejected. A few cocoons are brought rapidly to meturity in incubators heated to about 90 des. F., and turity in incumnors nesses to about vo about vo deg. F., and the consignment is not accepted unless healthy moths emerge from the sample occors. The concess are then placed singly in compartments or boxes marked with the names of the broods and stations, are give isolated in other ways, and are allowed to develop normally.

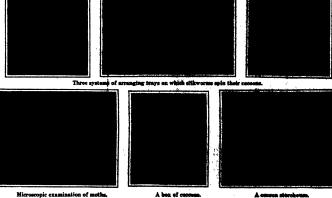
At the season when the moths emerge 300 women are employed, day and night, to trigeriessing the moths in cells of gause or waxed pages, which are mounted on frames and suspended from the celling.

implifitte implantation compute of implicit of its objective and for girts sent by the agricultural ecologies mad constituted expellents. These purple, from its to 196 in number, not only take passe of the lectures set to expert operation in the une of the microscope and other operations of perfectives. The pupils remain in serrespondence with the institute, which is thus brought into intimice velations with all which is the programme intermet versions with an alth-raising districts and its enabled to give useful advice wherever and whenever it is needed. All of the pupils receive free board and lodging during their winter solourn at the institute.

winder cojourn at the institute, and in various centers of sericulture by members of the scenarios staff of sericulture by members of the scenarios staff of the leatitate. In this way, instruction is given to many perigns who are unable of unwilling to attend the sequence given in Tvent, the squarion of former people is continued, and all persons increased in the pupils is continued, and set pursuant surveys in subject are kept intermed of the latest advances in

The long period of presperity which sitk culture formerly sujuyed in France proves that the climate is well adapted to

the cultivation of the mulberry and the propagation of silkworms, and that the present industry is due to the want of rational application of scientific principles. are a few French seriouitural exneriment stations t they are insufficiently en-dowed and are too much afraid publicity, initiative and responsibility to take official part cial transaction. Hence the French stations have no direct and close connection with the silk growers and give them little aid. With-out exactly copying the Tyrole which might not



SCIENCE TO THE AID OF SILEWORM CULTURE

The empty cocoons are stored in large re the few belated moths that appear are killed to grevent all danger of contamination. The mags of cocoons goes ultimately to factories of "schappe" (inferior slik spun from fibers which have been carded and not recied from the cocoon).

and not resided from the occom).

The imprisoned moths die after they have left their eggs. The cells are then opened, and the dead moths are examined with the microscope according to rules deduced from Pastour's celebrated research. There are shout three million cells, constanting 35,000 courses of eggs, and the work of examination conjugate four months. The work is highly specialized. Singer four months. The work is highly specialized. Singer rour months. The work is highly specialised. Some women do nothing enterpt expening the cells, others remove each moth and crusk it into a paste, which is carefully examined with the microscopic. The sage produced by the healthy moths are collected from the cells, washed with many presentations by expert spira-ators, and apread put to dry on primpin covared with

In addition to this industrial and on of producing and setting attawers one, the institute, endeavors to stimulate the program of serioustrys in general. For example, it has constructed an armit in which the pupe contained in 100 possess of excession. which the page contained in 100 presents of consumers on the billed in five minutes, and which is righted to all k culturities. There is also a drying changed to the culturities. There is also a drying changed the property of the culturities of the culturities

equally successful in a different environment, it would be well for the French stations to adopt the most im-portant features of the Bacological institute of Trent. The need is urgent, for the production of raw silk in France is diminishing so rapidly that the industry is threatened with extinction within a few years.

A Suggested Reorganization of the German University System

Fig. 18 German universities have hitherto been as-a supposi from the criticisms and the referenatory projects which is recent years have been directed against the general educational system of Germany. many peneral encontional system of cermany, many pears these iniversities have been at-ded, by great numbers of foreign students who, uses, upassing, critics of German political and lad conditions, have been unanimous fa-graise of the visitaritities. In the opinion of the eminent Ger-man themist, Prof. Wilhelm Ostwald, who discusses the subject in a recent issue of Die Umeches, this proves merely that the German universities are an proves morely that the Germán universities are de-perted to foreign universities, not that they are per-fect. The most distinctive and most admired feature of the German universities, which has made them the world's advocal or high accessible education, is the par-sonal influence, analogous to the failusance of the masses spain the apprention, which insuless; who have unless the same of the same of the same of the masses that the apprention of the same of the same unless that the particular area for the same part the satisfactor whose these are in tendencing to the field of original research. The foreign satisfacts are a selfa, most of supported with a peed delinquisty salid-tible education, for the purposes of barrains (the highest

reflect and the art of research. Hence they are graduated to the master's infinite presence and beater, and, working with him, experience the

magnitic and never forgotten joy of creative work. wall prepared devetoes of pure science, he ing on his h at exclusively native, who intend to follow tech sical pursuits and whose principal immediate interest is in the examinations. In the faculties of law, medicine and theology, such students form so large a macase and assembly seem students from the rape a ma-pority that they almost menopolise the professor's energies and make it impossible for him to establish a sphool of research with his few original in-vestigators. The philosophical faculty, on the contrary, is the true home of professors who, in ad-dition to their regular duties as teachers, accomplish much original research, with the collaboration of a fairly large body of embryo investigators.

But even here the incompatibility of the two sides of the professor's work almost always leads to neglest of one or the other. The more famous a pro-fessor's department becomes as a school of research, greater is his tendency to confine his personal tion to the students of research and to delegate to assistants the instruction of other students.

This difficulty is of recent growth. When the num-

er of students was small both kinds of instruction could be given by one person. The regular instruc tion of the beginners was usually carried on by as sistants, but even these students came frequently under the personal influence of the professor. This method is seldom practicable at present, as the numer of students is so large that it is physically impossible for the professor to give personal instruction to each individual as often as once in a week. The in-struction of the less advanced students, therefore, is left entirely to tutors. These indispensable and over-worked assistants have little influence in university councils and are consequently discontented with their position.

This discordance in the professor's functions is manifested even in his appointment. He is usually chosen in consequence of his accomplishments in the field of original research, while his ability to teach is to be n for granted, and treated as a matter of secondary importance. But many great investigators are ary importance. But many great investigators are poor teachers, and, on the other hand, a professor who strives conscientiously to fulfill his duty as a teacher cannot accomplish much original work. In teacher cannot accomplisa much original work. In their relations in the faculty the two types, the good investigators and the good teachers, stand in latent or open mutual opposition, as the latter feel that they are regarded as inferior to the former, although they—the teachers—best perform the immediate funtion of the university.

Hence we must expect a division, not prec een research and instruction, but between technique instruction and instruction in research, or even research without instruction of any kind. In other words, we must have schools for preparing students ow definite scientific pursuits, and other institutions designed for the advancement of science by original research, with or without personal instruc-tion, according to the character and special talent of that chiefs.

Institutions of this kind are already in exis In Frankfort alone there are several institutes (those conducted by Prof. Ehrlich and by Prof. Edlinger, for conductors by row, naturals and by row, naturally example) which are perfect illustrations of the type described above. They have nothing to do with technical education for special callings, and they accept only students whom the head of the institution re-

ards as promising collaborators.

The obvious corollary to this development is the return of the universities to the type of the technical school. This does not mean that university teachers will abstain from all original investigation. On the contrary, the younger men will undoubtedly do such according to their capabilities, if only for the But every university teacher will be required to devote his energies chiefly to the work of

In this way the faculty will soon be made homogeneous by the elimination of these who are especially well fitted for research, and a source of manifold diffie will be removed.

his transformation involves a reform in the inter-distance achools. It will finally be comprehended that the last two or three years of school work, as con displed at present in Germany, are a robi instead at present in Germany, are a rebbery of the membrand freedom of the scholar and the Intellectual saidth of the mation, and that these years could be some producibly employed it a university of the new low. In about, the German university must return, a claim degree, increaf the type of the Bungish and investigate confusion, from which it has been removed by larger paragraphic fair research to its 'unordense. These intellegementals in the state of the order of the larger paragraphic fair in the state of which is the control of the control of the control of the larger paragraphic fairs will in the districted without

A CONTRACTOR OF THE PROPERTY O

great opposition. In particular, protests against the "degradation" of the universities will be uttered by university teachers, and most loudly by those who are teachers rather than investigators

In the establishment of a new institution, at least, the sharp distinction between the two functions of the present university, which has already manifested itself in a practical way, should be borne in mind, and the institution should be designed exclusively for the uplishment of one or the other object, as it can not satisfactorily accomplish both.

A Balance for Weighing One Ten-thousandth Part of a Milligramme

WiTH ordinary chemical balances weights can be determined to within 1/10 milligramme (1/650 grain). This degree of accuracy is quite sufficient for most purposes, but greater precision is re quired for the solution of the new problems in chemwhich have followed the discovery of radium and other radio-active substances.

We know that radium, uranium and thorium are subject to slow but sure anontaneous decomposition and it is not impossible that other elements obey the same law. It is quite impossible to detect such decomposition by means of loss of weight if we employ ordinary chemical balances, for even radium loses ss than two millionths of its weight in a day, or 1/1600 of its weight in a year.

e and Grant have devised a balance which a loss of weight as small as 1/10000 milli e can be determined with accuracy. This balance, the precision of which can be increased to



A balance for weighing 1/10000 milligra

1/250000 milligramme, has already been employed b Ramsay to determine the loss of weight of radio-

The following description of this marvelously se ent is quoted from the Proceedings of the Royal Society.

The construction of the balance is illustrated by the accompanying engraving. The balance is inclosed in an air-tight metal case which is supported by three legs D, terminating in leveling screws which rest on a marble base B. The cover of the case C is attached to the bottom B by means of the screw The air is drawn from the case through the three way cock x, and the degree of rarefaction is indicated by the vacuum meter v. The apparai The apparatus is case is about 5 inches long, 4 inches high and 2½ inches deep. The beam of the balance A is constructed of very slender rods of quartz, arranged in structed of very stender rous of quarts, arranges in the form of two triangles, and is provided with a knife edge of rock crystal F, which rests on the metal post b. The balance pan b' is suspended from the light arm, while the left arm carries a quarts bead, which serves as a counterpoise. Especial care was devoted to the mechanism for stopping the oscillation of the balance, without injuring the delicate instru ment, affecting the accuracy of the weighing or admitting air into the case. By turning the handle p, the shaft I is rotated in the bearing m, causing the cam e to ruise or lower the spring q which is hinged ent of the spring is communicated to the vertical opinder g and the horizontal rod h, which carries two small triangles of quarts fibers which emission the arms of the balance.

stile to use weights of platinum

or even of quartz for the exceedingly delicate mes urements for which this balance was designed. The substitute for weights is the most original feature of the apparatus A thin quartz bulb a', filled with air and sealed, is suspended from the right arm of the balance, above the scale pan b', to which a small auxiliary weight y can be attached if necessary This part of the apparatus is contained in the glass tube t which projects below the bottom of the metal balance which the mouth of the tube is attached by an air-tight joint. A little phosphoric acid is placed in the bottom of the tube, to absorb every trace of moisture. The effective weight of the scaled quartz bulb a' increases as the air pressure inside the bal-ance case and tube diminishes

An experiment to determine the loss of weight of a radio-active substance is conducted as follows A little of the substance, not exceeding 1/10 gramme (11/2 grains) in weight, is placed in the scale pan and balanced by adjusting the weight of the quartz bead carried by the other arm of the balance. The final adjustment can be made with great accuracy by hear-ing the slightly too heavy head in the oxy-hydrogen been vaporised The movements of the balance are read by means of a little mirror, stached to the beam (directly under A in the illustration), which reflects the rays of a lamp to a cathetometer As the substance in the scale pan loses weight the equilibrium is disturbed, and the pan a' and quartz bulb b' rise. The loss of weight is determined by exhausting air from the balance case until the equilibrium is From the readings of the vacuum meter v at the two moments of equilibrium, the loss of weight can be calculated. A change of 1 millimeter in the reading of the vacuum meter corresponds to a change in weight of about 1/76000 milligramme. As the height of the mercury column can be read accurately to 1/10 millimeter, it is thus theoretically possible to detect a change in weight of little more than one millionth of a milligramme, but friction and other sources of error reduce the precision attainable in practice to from 1/10000 to 1/250000 milligramme.

Prodigals and Vandals

RESPECT for Nature and all her works is one of destruction and wanton waste of natural treasures are most generally deprecated Fortunately, we can not annihilate matter, but we can convert highly organized and even living matter into the dead products of total dissolution. To do this without adequate is abhorrent in proportion to the clearness with which we recognize our relation to the Cosmos, e., in proportion to the degree of our civilization. Although no one, probably, will question the correctness of this principle, almost everybody often violates it, usually in thoughtlessness rather than in malice.

protest against the wholesale slaughter of birds for their plumage has been made with vigor, and perhaps not altogether without effect. Laws designed to prevent the total extinction of game have long in force in all civilized countries, and all true sportsmen deplore the senseless slaughter of herds of antelopea and elephants in Africa.

Prof. Otto N. Witt, a distinguished German chemist,

who writes entertainingly of many things besides chemistry, and who devotes his latest contribution to Prometheus to the wanton waste of Nature's gifts, thinks that plants should also be protected by public opinion, if not by law He is heartily in favor of the sale of cut flowers and of potted plants, but he de-nounces the vandalism of edelweiss hunters Alpine tourists and summer excursionists in general, and withers with his sarcasm both the vender and the user of a costly basket crammed with dozens of un-potted and amputated plants in full bloom, ruthlessly butchered to make a German holiday and to advertise the wealth and liberality of the donor But paraphrase the words of the lamented Lorenzo the Seventeenth--what is Dr Witt's mean and petty German extravagance, compared to our royal Ameri can extravagance

Dairy Investigations

TWENTY-EIGHT new associations for the co-operative testing of cows belonging to members were formed during the year; 55 are now in operation Such tests, enabling the owners to discard unprofitable cows, raised the average annual profit per cow in one association from \$21.43 to \$42.82 in four years

The score-card system of dairy inspection recommended by the Department of Agriculture helped to improve sanitary conditions in dairies. It is being used in 117 cities and towns, including some of the largest cities Great improvement has been brought out in the milk supplies of a number of cities.

"'Aki," the First Japanese Dreadnought

Turbine Engines Drive the Ship at 20.2 Knots

A N event of more than usual importance to the A Japanese navy was the recent speed trials of their first dreadnought battleship, the "Akl," during which the vessel considerably exceeded her contract horsepower and speed. To Americans, the vessel will be of particular interest because of the fact that her propellers and turbine engines are of American design and manufacture, both of these being constructed at the yards of the Fore River Shipbuilding Company.

The "Ak!" was built by the Japanese at Kure, Japan. She was laid down in March, 1905, and completed in December, 1909 The vessel is 492 feet long, 84 feet broad, and has a maximum draft of 28% feet. Her tength over all is 499 feet, and the normal displacement is 19.750 tons The protection of the "Aki" moderate only, the main belt being 9 inches thick amidships, 6 inches at the bow and 4 inches at the amidships, s inches at the bow and a incress at the stern. The main battery is protected by from 8 to 10 inches of armor. In view of the fact that our 45-call-ber, 12-inch gun has penetrated 10-inch armor at 8,000 yards range, the protection of the vitals in this ship must be considered rather too light. The armament of the "Aki," however, is unusually heavy for a vessel of her displacement. All the guns are 45 calibers in Forward and aft are two 12-inch. On the

broadside, in two-gun turrets, are twelve All of these main guns are mounted on the upper deck, which has an averthe axes of the guns being, therefore, from 23 to 25 feet above the normal water line On the gun deck are twelve 6-inch, widely distributed, eight of these being protected by the 6-inch armor of the central battery. The tor-pedo armament is heavy, consisting of five torpedo discharge tubes. The "Aki" has the great defect that when she is fighting a broadside enwement no less than six of her 10-inch guns, being on the lee side of the ship, will be masked by the smokestacks and the turrets on the opposite beam, and will therefore be

The Curtis turbines with which the "Aki" is driven are 12 feet in diameter, and they were contracted to show an aggregate horse-power 24,000 The vessel originally designed for 19-

knot speed, which was to be obtained with reciprocating engines, but subsequently, it was resolved to substitute a pair of Curtis turbines driving twin propellers.

In the recent progressive official trials, at 94 rev lutions per minute and 1,352 shaft horse-power, the 'Aki" was driven at 8.4 knots for a consumption of 319 pounds of steam per horse-power per hour At 160 revolutions and 5,773 horse-power, the speed was 139 kinets for a consumption of 195 pounds of steam per horse-power per hour At 221 revolutions and 16,115 horse-power, the speed was 186 knots for a consumption of 15.3 pounds of steam, and at 25.9 revolutions and 27.740 shaft horse-power, the speed was 20.2 knots for a consumption of 14.4 pounds of steam. The Minister of Marine of the Japanese navy was so highly pleased at the showing of the ship that he sent a congratulatory telegram to the commander upon the completion of the trials, which action was upon the completion of the thank, which action was "very unusual and very gratifying to the captain and the men." A sister ship to the "Aki," the "Satsuma," is also practically completed

Growing Old

FROM a recently published account of the lives and habits of a number of very old persons it appears that none of them made a study of hygiene, appears that none of them haste a study of hygienic, visited health resorts, indulged in recreation tours, or termented his body with the multitudinous drugs and instruments of the art of healths. The secret of their iong and healthy lives is found in moderation in eating and drinking, a calm disposition, and regular

A great many persons are doomed to death, preceded by long suffering and progr d to premaiure reseive de bility, by the rapid wearing out of some vital orgathe heart, lungs, kidneys, liver, brain, or a The recognition of the causes of such disease gests methods of preventing them. More suffering, premature old age, and death have been caused by the undue importance formerly ascribed to an abundant supply of albuminous food than have resulted from many famines. As a furnace is choked by incessant stoking, so overfeeding from infancy paralyses sant growing, so overlessing rous intance, paralyses the activity of the excretory organs (kidneys, liver, glands, etc.), the organs of circulation (the heart and arteries), the nervous system and the organs of digestion. When too rich a diet is supplemented by regular doses of alcohol, every condition favorable to early collapse is provided.

The recent investigations of Prof. Chittenden have proved that the most healthful ration of albumen is very much smaller than had been assumed, and that five or six ounces of albumen per day are quite sufficient for a hard-working man. With this comparacient for a hard-working man. With this compara-

Displacement, 19.730 tons. Speed, 50.3 knots. Armer: Belt, 8 inches; main gan positions, 16 inches to 8 inches. Armens
Four 45-caliber 19-inch; twelve 45-caliber 19-inch; twelve 45-caliber 5-inch. Torpacie tabox, 5 submerged,

The Japanese dreadnought "Aki" making 20.2 knots on trial

brighter and the mental powers are incre Life is shortened, also, by changes in the connective tissue which binds the organs together as appears most conspicuously in the tendons, ligaments membranes, and skin. Many of the obvious phe-nomena of old age are caused by the hardening of this originally tough and elastic tissue which, like India rubber, losse its elasticity through age and disuse, producing bowed shoulders, stiff joints, wrinkles and brittle arteries. The bardening and shrinking of connective tissue extend to the brain, and explain the fact that recent events are forgotten while youthful experiences are vividly remembered. The deep and permanent impression which thoughts and occurrences make in the soft wax tablet of the young brain becomes impossible in age.

All of these things point out the means by which premature sensity can be averted and old age pre-vented from becoming a burden and a torquett-moderation in eating and drinking, ample rest and-regular moderate avarcise of all the bodity organs, to retard the stiffening of connective tissue.

f. Chittenden's albuminous ration for a hardworking man stands in striking contrast to the great quantities of meat eaten by many men of sedestary habits. The exercise required by the muscles and joints can be obtained by a regular system of ex which need not occupy much time.

Dr. Meyer, whose article in Illustricte Zeit here summarised, recommends the system devia J. P. Mueller. Such exercises, of course, should be in time, as they are preventives, not cures, for sec Daty long walks, preferably in the megalities, to invigorate the heart and the atroubilities. Vigorous starcies is impossible, or when it is do prepare for it or supplement it, meaning without useful. Swedish Jacoba membage produced will b

usered by the control of the control ing, thinking, interest in sports, contact with nientally stimulating persons and social interceurse with young people are recommended. Occasional journeys, young people are recommended. Constinuit journeys, despits, or rather because of, their many disagreeable concomitants of noise, hurrying throngs, rapidly changing sights and sounds, and variations of atmospheric pressure, appear to attmitist the antite organism, while absolute rest and indicates pressure appear and the antite organism. While absolute rest and indicates pressure the hardening of connective tissue and the accumulation of fat. Exercises in memory prevent and diminish hardening of connective tissue in the brain as bodily movements prevent the general stiffness of old age. In short, the most formidable enemy, con-sective tissue, should be kept mobile everywhere in er to preserve elasticity of body and mind.

As many persons exhibit a steadily increasing in-plerance of alcohol, tobacco, and coffee, the enjoyment

of these luxuries should be restricted, and should be entirely renounced in all cases where there is a predisposition to apoplexy or chronic kidney di

The average term of life appears to have incres in the mineteenth century, and there is every reason to believe that it is still increasing. The world will be greatly benefited when its old men shall be able to increase and utilise for the common good the fruits of their long experience, and when men like Cornero, who wrote scientific treatises at the age of 95, and the eminent Latinist, Prof. Mayor, who is still working diligently at the age of \$5, shall not be rare exceptions.

Improving the Port of Liverpool

LTHOUGH the port of A LITHOUGH the port of Liverpool will not be the British terminal for the new White Star liners. no cessation of the activity in dredging operations and development of dook facilities for the improv

ment of the port is being displayed. Last year the five dredgers in the service of the authorities removed 15,879,460 tons of sand from the bar obstructing the 15,549,800 tonu of sand from ten har observacting the entrance to the channel, of which agreement he new huge dredger "Levisthan," fully described in the SCHRUITC AMERICAN, raised 12,121,700 tons. Since dredging operations were seriously taken in hand in 1890, no less than 152,541,010 tons of sand have been ed from the shoals at the bar, and the result is removes from the should state be read the feet wide with only one sounding less than 53 feet at low water equinorial spiring tides, while in the part of the Queen's Channel lying between the bar and Formby lighthain p, minimum depth of 37 feet has been secured, and the rest of the channel has a depth of 31 feet. secured, and the rest of the engines has a capth of \$1 feet or more over a width of 1,000 feet. The construction of a new dook estimated to cost \$3,500,000 has been commenced, and this is the first instalment has been continuenced, and this is the first installment of an extended color improvement scheme computed to entail an exposure of \$17,500,000. The enew destril he shouth 2,200 feet in length, with an astrance 130 feet wide, and having a depth of \$5 feet on a treat policy of the suppression of the feet on a versity-feet title, will be approached by a channel delibert in width at the mouth neurowing to 130 feet wide at the footh will be approached by a channel delibert in width at the mouth neurowing to 130 feet wide at the footh continuence. This dock will be fully experied of commoditating the new 45,000-ten. White Ster inners, self-the improvement scheme here been taken in highed his miset the requirement of the 48,000 to \$2,000-ten. Sterne the requirement of the 48,000 to \$2,000-ten.

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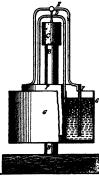


How do You Like the Home Laboratory?

THE referendum on the question of publishing and affect workshop every two work, instead of come a month, has brought in a number of letter expireting approval of the Home Laboratory. Buch letters are a preat help to the Hetter of this department, He wonist to hear from all his readers. Tell him how you like the department and what features interest you. If you wish that certain subjects were left out and others put in, do not hesitate to say so. The Hitter is always plat to receive contributions for the Home Laboratory, and he pays for them promptly if they are essitable.

A Combined Battery and Motor By Chauncey W. Nieman

THE apparatus here described is probably the simplest and most self-contained electric motor it is possible to make. It has no brushes, commutator, windings, or other parts commonly associated with a motor. Moreover, it has its own bistery within itself. Any oneover, it has its own bistery within itself. Any oneover, it has its own bistery within it-



Combined battery and motor.

is quite puzzling, as it is so different from any other machine of its kind.

In the illustration A is a wooden base with a hole in the middle in which the bar magnet \$R\$ is inserted. This magnet should be as large as can be obtained and \$8\$ to 10 laches long. Two slender magnets can be fastened together with the poles against such be fastened together with the poles against such other if a single magnet of the right size is not readily obtainable. Over the top of the magnet the cork \$\mathcal{C}\$ is a fingle magnet of the right size is not readily obtainable. Over the top of the magnet to cork \$\mathcal{C}\$ is sheet, which has a hole cut for the purpose. In the top of this cork a needle is stuck, point upward. At \$\mathcal{C}\$ is an annular vessel of thin sheet copper. At \$\mathcal{C}\$ is an annular vessel of thin sheet copper, one to \$\mathcal{C}\$ and she could do of the readed together. When this is done all the soldering appearing on the lastide of the vessel must be painted or covered with paraffine so as not to be acted upon the old. The vessel is suspended by the wife \$D_* attached to \$E\$ in two places. This wire is being time to lead of a hasetene.

the needle a conterpuesson was a best and a circle, of sheet of thick sinc is then bent into a circle, of such site as to be the copper vessel and be at about, equal distances from the Inside and outside water. To the top of the stne critisade the wire for attached in two pisces by saider or by passing threats two little knies in the critisde. At the top of the long is second needle is soldered with its point disease, and in the upper side of the wire D another content insulation of the country size, thus it is made to receive it. Both the longs is and if it is not better as to be as close the country of the magnetic of the country of

The section my the apparatus, as, shown and filling

the copper vessel with dilute acid the current may be caused to pass up on both sides of the wire Janad come down on both sides of the wire E. The outer vessel will then immediately start to turn in one direction, while the inside cylinder will revolve in the opposite direction, producing a very animated effect. The action will continue as long as the acid holds out. The apparatus will last a long time, as there are no parts to get out of order, and the simple but effective mechanism will prove a constant source of wonder to admiring friends.

Projectile Photography

By Norman Barden

N EARLY all of the fascinating work of photographing projectiles in flight has been done in large laboratories, and those interested in this subject have felt that they had not the required ap-



The bullet emerging from the muzzle. Note the smoke preceding the bullet.

paratus for such experiments. Now the purpose of this article is to set saids these ideas and to give a clear idea of the whole operation. It may well be said that any student attending a school or college possessing a physics laboratory can succeed in obtaining good negatives of projecties in flight. As a rule the most serious drawback is the lack of an induction machine, but it is quite possible to use an induction coil in its stead. In the following lines a description and explanation of the complete operation as carried out by the writer in the physics

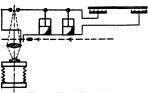
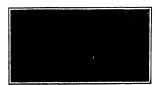


Diagram of electrical connections

laboratories of the East High School of Minneapolis, Minn., will be given.

The apparatus used in this method of photographing projectiles in flight consisted of an induction machine, a battery of Leyden jars, a spark app, large condensing less and a camera A view of the complete apparatus arranged in a working condition is shown herewith. At the extreme right will be seen the gun clamped rigidly to the table Placed on the table to the left and back of the gun is the induction machine. Just to the left of the state letteric machine is the battery of Leyden jars. Then further to the left is the spark gap, directly in front of which



The bullet in flight; muszle velocity, 903 feet per

are the confidential plans and camera respectively. The framework which shows sear the Leyfout jars is a device for holding two wires by means of which the spark is caused to jump at the spark gap by the bringing of the two wires referred to in contact with one another. The whole operation is carried on in a perfectly dark reom save for a dim ruby light. The strangement of the apparatus is clearly shown in the accompaging disgram.

arrangement of the apparatus is clearly shown in the accompaying diagram.

The arrangement of the apparatus is as follows: The run is first clamped tightly in a rigid position. Then a target for stopping the bullet is put in position. A target can be made either of blocks of

wood or by tying several thick magazines together. Before arranging the rest of the apparatus the path of the bullet must be found. This is done by placing two pieces of cardboard in vertical positions in the apparent path of the bullet. Put one about a foot in front of the muzzle of the gun and the other a foot to the far side of the point where the camera is to be placed. A shot is now fired, puncturing each cardboard Now by sighting through one hole in the cardboard to the hole in the other, the path of the built may be located to a nicety. The next piece of apparatus to be set up is the framework for holding the contact wires or strips in the path of the bullet. The contact wires are placed vertically and must be exactly in the path of the bullet. For the contact wires or strips No 36 copper wire or leaf copper wire will serve the purpose very well. Having put the framework in the proper position proceed to place the spark gap and the condensing lens and camera in their positions. There can be given no definite measurements for the placing of the last named pleces of apparatus, as different experimenters will probably have different kinds of instruments. However, it is best to place the condensing lens, which should be five or six inches in diameter, about two inches from the path of the bullet. Set it on the side on which the camera is to be located. A condensing lens having a focal length of about six inches will be found to be very well suited for the purpose Now put the spark gap at such a distance from the lens that the pencil of rays converging from the lens will be brought to a focus at about eighteen inches from the path of the bullet. Then place the camera so that its lens is at the focus of the pencil of rays just referred to 'The camera should be focused on the path of the bullet in order to get a sharp image of the projectile The ontical axis of the comers ought to be perpendicular to the path of the bullet, and the spark gap placed on this axis, also the axis of the condensing lens should coincide with that of the camera. For a clear idea of the arrangement of these pieces of apparatus consult the diagram.



Arrangement of the apparatus for photographing a bullet in flight.

the Leyden jars and the induction machine in any convenient position. By following the arrangement in the diagram a great deal of unnecessary wiring and a large amount of electrical leakage which is at times very troublesome will be avoided. Connect the machine with the Leyden jars and the jars in series with the spark gap and the second break, thereby making two breaks in the circuit. For the connecting wires annuclator wire may be used; but it should run from one connection straight to the other Wherever the wires are to be supported they must be highly insulated. Pleces of glass tubing are very convenient to use. Also wherever a wire insight touch anything which might give way to leakage or a short circuit, insulate it with glass tubing or mica. Having put the apparatus in a working condition proceed to try out the experient.

First of all see that the contact wires are placed exactly in the path of the built and that they are about a quarter of an inch apart. Bend one wire as that the other will surely come into contact with it Adjust the spark gap so that the terminals are about a quarter of an inch apart. Now operate the machine until the current jumps through both breaks. Do this several times and look for defects in the wiring. On finding everything all right, stop the machine and fully discharge the Leyden jars. Now find out how many turns of the induction machine handle will charge the jars so that they will discharge through both breaks. Do this several times, discharging the jars bother seven the part of turns. Now the day to the several times, discharging the jars between each trial, and find the average number of turns and then push the contact wires together with a glass rod or other good insulator I if the spark is produced at the spark gap when the contact wires are brought within a riterenth of an inch of each other, the correct number of turns has been found Now load the span and cook if ready for fring, turn the handle of the static machine the correct number of turns and at the last turn fire the gun. At the

same time watch the spark gap to see if the spark was produced or not. After having put all the apparatus in a working condition try a plate

Nothing has been said heretofore regarding the kind or size of plates or the kind of camera to be used. For the camera one with a lens of large aperture is preferable to one of small aperture. However, the lens of almost any camera may be used if the pencil of rays coming from the condensing lens is focused exactly upon the center of the camera lens For the plates, fast ones are best to use, and the faster the plate the better the picture. The writer used Lumiere Sigma plates with good results The plates should be large enough to show about four or five inches of the path of the bullet. By consulting the illustrations it will be seen that the contact wires were placed so that they just showed on one side of the plate, thereby leaving the rest of the plate to catch the pro-

After exposing the plate develop it immediately or in a short time. Use any reliable developer and use a solution of such strength that developing will not have to be carried on for more than five minutes. Fix the plate in a strong acid hypo solution and let it Fix the plate in a strong set nypo source an are ri fix about twice as long as it takes it to clear. Wash the plate thoroughly and dry it in such a position that the dust will not settle upon it. It will be found convenient to make the dark room in which the experiment is carried on, serve as the photographic dark room. This saves a great deal of time as well as trouble. If the foregoing instructions are followed, the writer feels confident that there will be no great trouble in obtaining good negatives of projectiles in flight A great deal depends upon the experimenter, he must depend upon himself to correct some possible defects which might arise from his methods of wiring and arranging the apparatus There is still a large amount of knowledge to be gained by this fascinating work, and it is within reach of a great many who do not realise the possi-

bility of their carrying out this experiment
In one of the illustrations at the left is seen the muzsie of the gun and the projectile which has just emerged from it. Around the back part of the projectile are seen the jets of expanding gases. The volume of smoke and gas which precedes the bullet from the barrel is shown very plainly. The white streak is the spark between the contact strips. Many interesting and instructive pictures of this sort are in reach of those who follow out the foregoing explanations and instructions.

The writer wishes to say that he is greatly indebted to Prof. J. R. Towne, of the Department of Physics at the East High School of Minneapolis, Minn. as it was through his kind permission that the use of the laboratories was obtained for carrying out this interesting experiment.

Neat Method of Testing Shutter-speeds By H. H. F. Clarke

I is always better to test the speeds of instantane-ous shutters to see if they give the correct ex-posures after one has had them for some time, more especially when they are bought second-hand. In some cases the wood either swells or contracts. This is due to various causes, chiefly sun and damp, and the shutter, though apparently running freely, runs slower due to friction.

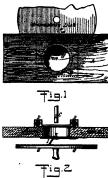
Take a piece of fairly thin board AA and drill a small hole through it. On one side of this hole at tach, by means of a very weak spring, a sheet of mica K so that it just touches the board. A piece out of a discarded recorder does very well. To the center of this fasten another light spring I, which has a very fine brush composed of a few camel hairs tied on the end. Do not attach the springs (which can be made out of watch main springs, softened, filed down, and then retempered) with sealing wax, as it is too brittle. Some of the cements used for mending china do very well, or even strong spirit gum does at a pinch.

Now take a worn-out gramophone disk and paste white piece of paper of the same size over it

The paper should be out to the required size a good layer of paste put over it and laid a good layer of passes but over it and taid added for ten innities, then another layer of paste applied and the whole firmly pressed against the disk. The paper will then dry with a perfectly smooth surface. The object of the first layer of paster is to stretch the paper, which, when placed on the disk and allowed to dry, shrinks, thus forming a per-fectly level surface.

w fit the prepared disk on a gramophone and clamp the apparatus, described above, so that the little brush, which has been previously soaked in some coloring matter (red ink does very well) very nearly touches the paper, but as near its edge as possible. Set the gramophone running at a known rate. shutter to be tested over the hole in the wood and roject a gentle stream of air, either with the mouth r foot bellows, through the tube C against the shutter DD BB. Release the shutter, and the stream of air passes through, reaches and depresses E a fraction of an inch and causes the brush I to mark a line on the gramophone disk G.

Now, say you set the gramophone going at 120 revolutions a minute, divide this by 60. Then the disk makes two complete revolutions in a sec



Testing a shutter with a s

Measure the distance from the mark made by the Ave-soaked brush to the center of the disk; call it x. Multiply this length by 6.28. Then $6.28 \times x$ is the distance traveled by a point on the disk, at the same distance from the center as the brush, in one complete revolution. Now there are two complete revolutions in one second, so the distance traveled in one second is $6.28 \times x \times 2$. Now measure the line marked by this brush; call this y. Then the speed of the

shutter will be
$$\frac{y}{6.28 \times x \times 2}$$
 seconds, or expressed in $\frac{6.28 \times x \times 2}{6.28 \times x \times 2}$ another way part of a second.

Most gramophones and phonographs have an accurately governed motor, and when the regulator is put at a certain mark the disk travels at so many revolutions a minute. If this is not the case with yours, you can easily determine its speed with a little ingenuity. Either notice how many revolutions the disk makes for one revolution of one of the slower running gear wheels, and from this calculate the number of revolutions in a second, or else fix a small piece of white paper to a disk and count the n sses a certain mark in a definite number

of seconds (a convenient number is ten).

Either a gramophone or phonograph may be employed. Perhaps the gramophone is a little better, as ployed. Perhaps the gramophone is a little better, as the line you get is longer and so your work is a little more accurate if anything. It is necessary to notice that the apparatus is fitted up so that the springs brush is not torn off when the mice plate is depressed by the current of air. If fixed up in one way, as can easily be seen, the spring will be bent back and prob ably torn off the plate

Improvised Stereescopic Camera By John E. Mellish

THE writer possesses a 5 × 7 camera with a ceptionally fine lens and with a double extended Desiring to take some stereoscopic views with



le pioture tahun with a ningir kum.

start with a stand was or flat top fifteen inches squa Wiveless staroscopic views were small sufficient the latter was set on the stand against the latt is little to one side of the center, and the ing was siene carefully on the ground man lens was stopped down in order to bring out clearly. After exposing one plate the camer moved sidewise and a second view was taken. objects near by the camera was moved laterally three inches, but for distant objects and some ement was as much as a fe



way two views were obtained that were found to with wonderful distinctness in a ster The accompanying illustration shows views taken in this way. It was essential in this case to pick out an hour when no wind was stirring so that there would be no blurring of the leaves.

Silvering Reflectors

SEVERAL letters have been received by the Editor of Home Laboratory, complaining that the directions given in the article on the Construction of a Four and One-half Inch Reflector must be wrong; for even though they were carefully carried out no silver would adhere to the glass. The failures appear to be due to the following causes: First. Nitric acid containing a trace of chlorine would give a faint pre-cipitate which would prove fatal in getting a per-fect deposit of silver. Second. The glass may not feet deposit of silver. Second. The siass may not have been made sufficiently clean. Third. Common water if used to mix the chemicals for the solution would also cause precipitate of silver chioride, sufphate, and an organic compound of silver, thus caus-ing failure. The water used for the mixing and

ing raisure. The water used for the mixing and final washing before silvering must be distilled water. The following solution for silvering can be entirely relied upon, but distilled water must be used in making the solution. The process is known as "Martin's Silver Process!

Solution A. Nitrate of silver, 175 grains; distilled water, 10 ounces. Solution B. Nitrate of ammonium, 262 grains; distilled water, 10 ounces. Solution C. P., caustle potash, 1 ounce (av.): distilled water, 10 ounces. Solution C. P. caustle potash, 1 ounce (av.): distilled water, 10 ounces. Solution D. Pure white sugar candy, ½

10 ounces, Southon D. Fure white sugar ossuer, 72 ounce (av.); distilled water, 5 ounces.

Dissolve this by heating the flask and add fifty grains of tartaric acid, boil this mixture for ten minutes in the flask and when cold add one ounce of pure photographic alcohol, made up to ten ounces by adding distilled water.

For use mix equal parts of A and B in one gradu-ste, and equal parts of C and D in a separate gradu-Finally mix these two together and suspend the se to be silvered face down in this mixture; allow

glass to be silvered face down in this mixture; allow it to stand until the deposit of silver is complete. The glass can be cleaned by very carefully washing it in a warm solution of common washing soda, with a tiff of absorbent cotton pressed in the end of a stour rubber tube and used as a mop. Wash well under the faucet, then rinas well in a mix-turb of nitric seld one part to forty of water, and rinas well under the faucet. Finally wash

in distilled water, drain, and then immerse in the silvering liquid.

Tunesten Wire

Ductille metallic tungston is now pro-Duced in the electric furnace. Dungston narticles have been hitherto welfed into a nea tiquous flament by passing an electric curves through a blading material constanting the satellite particles and circum off by the high host. By this new method the metallic impass one, be drawn late, the wire, mind, drawn and more runged than the electric discusses.

TO EAST OF THE PARTY OF THE PAR

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

mes J. Newton

by HE subject of this sketch was born to a farm in Morgan County, Georgia, July 17th, 1861, the sixth of a family of eight children. Both his parents



James J. Newton.

were strong and vigorous, and he in herited an iron constitution which has enabled him to make the exceptional record of attending to his official duties for a period of fifteen years of official life without a day's absence on accoun

Mr. Newton was educated in the com mon schools and the University of Georgia, from which institution he grad with distinction in 1881. elected to the position of Instructor of Chemistry and Physics in the South Georgia Agricultural College at Cuth-Georgia, in 1881, and in 1885 was elected principal of Lee Institute at Thomaston, Georgia, where he taught un til he came to Washington in 1890. In took the examination for admis sion to the Patent Office examining force and was appointed fourth assistant ex sminer in March, 1891, and assigned to duty in Division 9. He passed his fi-examination for promotion in Novemb ad his first 1892, standing fifth in a class of about fifty fourth assistant examiners. He was e law clerk in May, 1893, chief clerk in 1894, and principal examiner in 1895 and assigned to duty in Division 23, where he has served continuously eve

To this division was attached the p ent division of trade-marks until 1897 and in addition thereto the class acoustics, measuring instruments, including weighing machines, adding machines, cash resistary atc. and horology

As indicating the wonderful growth of these arts since 1895, trade marks have been assigned to a separate di-vision, and the work of a large force is necessary to their examination. Acous-ties, including phonographs, which in only required a small portion of one man's time, now take up one man's tire time; and adding machines, which were all examined by one man, now rewere all examined of one man, now level up the up the work. Probably three-fourths of the patents in these, arts have been is said affine Mr. Newton took charge of this styleton in 1885.

his division in 1879. One of Mr. Newton's strongest char-obscience is attention to business. He is think assistances worser. If you want as med assistance were in you wanted to find him to see him, you are certain to find him to find seek and just as certain to find him at week. He same hind the writer he had seek to the hind the seek and the seek of the seek of the most different ways of the most different to the seek of t

A CAN A CAN

versity in 1895, and is the author of "Newton's Digest of Patent Office Trade-Mark Decisions." published in 1896.

A Film-developing Machine By A. A. Somerville

THE accompanying illustration show a new apparatus designed by Prof. George S, Moler of Cornell University for use in developing photographic films. The device excels in its simplicity-all parts are plainly in sight. It was constructed to fill a definite need, to supply which there is nothing on the market.

The vessel containing the developer is an Ingento tank, this type being chosen as particularly adapted to the mode of cal, and in operation the film slides over bottom, following its curvature, and is immersed in the developer in such turned by means of the handle shown in is immersed in the developer in such turned by means of random shown in way as to present to it the gravest post the figure. The operation is perfectly sible length of film. A rod extends from simple, and the apparatus is quite free one end of the tank to the other, about from all complicated features.

It is one of the drawborks of the dayand the film is passed through under light developing tank, that it requires an this rod, so as to be held down under undesirably large amount of developer.

kind and required constant and diligent transverse red is shown turned up out tended for dark room developing, of the tank.) In the ordinary use of the tank hank.) In the ordinary use of the tank that the tank the difficulty arises that it is from the law school of Georgetown Universe the time of the tends of the troublesome to hold the ends of a long film out at arm's length and rock them to and fro with the requisite secsaw motion. A person is almost sure to fall into the habit of holding the film in the shape of a V, and if the angle of the V is spread out too much, as it is very apt to be, the film drags over the edges on either side of the tank, and by hesion raises the developer out of the tank and spills it over the working table.

To remedy this defect, and at the same time gain other advantages, a drum of hard rubber was built on the squirrel-cage pattern. The film is passed in a loop around this and over the transverse rod in the tank, and the two ends are pinned together so as to form a con-tinuous belt. The height of the drum can be adjusted to suit the length of the film. In developing, the drum is merely

the surface of the liquid while the ends The apparatus here described is free of the film are passed in and out in see-from this objection, owing to the share saw motion. (in the illustration the of the ingento tank. It is, of course, in

was primarily designed for use by the

A film-developing machine.

laboratory.

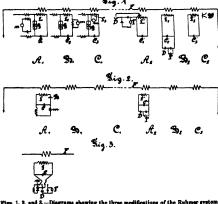
The Ruhmer System of Multiplex Telephony

E RNST RUHMER of Berlin has developed and patented a system of multiplex telephony which closely resembles the system which Major George Owen Squier, of the United States Signal Corps, has invented and presented to the public, as was narrated in the SCIENTIFIC AMERICAN Of January 21st.

The Ruhmer system is very clearly and succinctly described in the French patent, issued September 16th, 1910, from which the following description is adanted

The invention relates to a method of transmitting several telephonic messages simultaneously over a single wire. The messages are transmitted by means of alternating currents of high and different frequencies, analogous to those employed in wireless telephony. These currents are superposed on the line wire and are separated at the receiving station, where each current acts upon a special receiving apparatus, through the agency of an oscillatory circuit attuned to the pitch of the oscillatory circuit which produces that current at the transmitting station. In this system the different rereiving circuits are inductively connected with each other and the line in a comparatively loose or weak manner, in order to obtain a perfect separation of the messages and to assure the proper reception of the feeblest of them, thus preventing confusion in the case of simultaneous transmission of a large number of

Three modifications of the system shown in the diagrams In Fig 1 three synchronized pairs of transmitting and selving apparatus are denoted by A, A_s The high frequency B_1B_n C_1C_2 The high frequency current is produced by a generator of known type, for example, an electric arc G connected in parallel with an oscillatory circuit CL, the frequency being regulated by the values of the capacity C and the inductance L. The intensity of the high frequency current is affected by the microphone m, which may be bridged across the terminals of the inductance coil L (as in the third apparatus C.), or of an auxiliary coll in the oscillatory circuit (as in B1), or may act inductively



grams showing the three modifications of the Ruhmer syst-

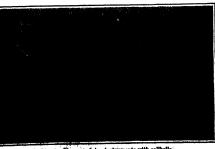


Fig. 4. - Three comiving instruments with calibella. RUHMER'S SYSTEM OF MULTIPLEX TELEPHONY

on the feed circuit (as in A.). In general, any method which prevents each microphone from affecting any transmit ting circuit except its own may be em

At the receiving station each high fre At the receiving station each angia frequency current produces resonance in a synchronized oscillatory circuit \mathcal{O}^*L' , and thus acts upon the telephone receiver T by means of the detector D, as in wireless telephony. Two arrangements of the detector, telephone and oscillatory circuit, are shown in A, and B, but the detector may be omitted and the mes sages received directly by a Foucault current W. as in C.,

Fig 2 shows a simplified apparatus which does not include any special device for producing high frequency cur rents. Speaking into the microphone m generates in the oscillatory circuit, comance L. trains of damped vibrations hav ing a frequency equal to the pitch of the

Fig 3 shows an apparatus which can be used alternately for transmitting and receiving messages. The same oscillatory circuit is used for both nurposes and is connected, by means of a commutator, with the microphone m and the battery. or with the detector D and telephone T. or desired. The commutator may be so constructed that it also modifies the in ductive connection of the inductance L with the line F, making the connection closer or stronger for transmission and looser or weaker for reception.

The accompanying photographs (Figs 4 and 5) Illustrate a set of transmitting and receiving apparatus which was sent to the Brussels Exhibition last year, but was not exhibited because of the fire which so greatly injured the exhibition In this apparatus the electric oscilla tions are generated by Poulsen area Only three pairs of instruments were employed because the apparatus was signed merely for demonstration. The instruments worked well, without inter-fering with each other Herr Ruhmer writes that he has used his apparatus with success on ordinary telephone circuits with wire return. He adds that the first idea of multiplex telephony oc curred to him early in 1907, and is mentioned in his book on wireless telephony, published in that year. The first demon-stration of his system was made in November, 1908 He applied for the French patent on April 5th, 1910, and for the Belgian patent still earlier, on March

Progress in the Aluminium Industry

I N a circular issued by the United States Geological Survey, W C Phalen makes some very interesting statements, which are reproduced below

RECENT PATENTS.

In consequence of the great demand for the Aluminium Company America made extensive additions to its plant equipment in 1907. This great increase in plant capacity was followed by the business depression of the fall of 1907, as a result of which there have been few new developments to record since the beginning of the year 1908, the completion of projects already under way In the matter of excepted. invention. however, the aluminium industry has kept pace with its former records. Perhans the most interesting recent inventions are a group patented in December, 1908, by F. J. Tone, superintendent of the Carborundum Company's works at agara Falls, which have for their object Aluminium is used in constantly inand the formation of pure alumina as a
hyporoduct. Calcified kaoiin (clay) is
mixed with carbon in the electric fur
mace. Under proper regulation of the
heat, the oxygen of the silica becomes absorbed, which results in the production
of elementary silicen; iron oxide, if preent, ir reduced to metallic from; and sill so is used in the new
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of elementary silicen; iron oxide, if preent, ir reduced to metallic from; and sill so is its application in the newall so is largely in the silication of the
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titanium. The alumina thus purified from metallic oxides remains behind unreduced. If iron is mixed with the charge ferrosilicon is obtained. The reactions ferrosilicon is obtained. The reaction reduced to their simplest forms are a

AlaOa, 2810a + 4C + Fe to AlaOa + FeBla + 400

Al-Os. 2810. + 40 = Al-Os + 281 + 400.

According to Tone, the silicides pro duced in this process are useful for vari-ous purposes, such as the refining of iron and steel, and the alumina is useful both as an abrasive and also as an ore for the production of metallic aluminium the way appears to be opened for the production of metallic aluminium from kaolin or clay, a goal that has been long sought by many experimenters.

RECENT APPLICATIONS OF ALUMINIUM

Recent progress in the application of aluminium in the industries has been summarized by Joseph W. Richards. He gives an account of the use of metallic aluminium in aluminium coins, in alum inium paper, and in aluminothermy in making alloys and bronzes. He also de-votes some attention to welding processes in which aluminium is used, and to miscellaneous uses of the metal.

Aluminium is used in iron and steel works for removing oxygen from the oxides of iron and other substances, the heat generated being so great as to raise the temperature of large bodies of iron. qualities of lightness and stiffness a

In castings it has been found at vantageous to allow the metal with cop-per, sinc, or nickel, which indicates its strength and makes it costs to work oup-m its The prevailing low prices of taget afturinium have resulted in a greatly enlarge demand for the metal for such work. The principal demand for such castings has come from automobile builders. users of brass castings, especial 770 th manufacturers of electrical apparatus have been gradually changing from brass to sluminium castings, and for some purposes aluminium castings have substituted for iron castings. The use of sinc for hardening purposes has been condemned by some writers, but according to Jesse L. Jones this condemns tion is unwarranted. According to this writer, "where cost is not of primary importance, where castings must be bent and where the alloy must be as light as possible, copper-hardened siuminium should be used; but where a moderately light alloy is satisfactory, where castings do not have to bend, where low cost of production is essential and a high tensile strength is desirable, properly made aluminium-sing alloys leave little to b desired.

Aluminium is one of the most malle-able of all metals. Moreover, it takes and retains a very high polish. For these reasons it is used in connection with the manufacture of articles of every

Fig. 5. -- Three transmitting instruments operated by Poul RUHMER'S SYSTEM OF MULTIPLEX TELEPHONY

It also has the power of combining day use almost without limit. Some of chemically with those gases imprisoned during the cooling of the metal, thus preventing porosity. For these purpose metal is either used in the form of an alloy known as "ferroaluminium," or as the pure metal, either in the granulated or bar form or in small pieces weighing uniformly one-eighth or one-fourth of an This property of keeping ounce each molten metal hot or of raising the tem perature of a molten metallic bath has been utilized in the thermit welding pro-cess, invented by Goldschmidt. In this process aluminium and iron oxide are intimately mixed in a finely divided state and ignited by means of a fuse. The action raises the temperature of the cast ing to the welding point. takes place in a funnel-shaped crucible from which the fluid metal resulting from the reaction is run into a suitable chaped mold formed around the area of the joint to be made, which is preheate by means of a blow lamp to avoid chil ing the first lot of metal coming through

these new uses are as wall "paper," ing panels, stamped or hammered trays finger plates, etc., in the form of very thin sheets; as a substitute for litho graphic stones and sinc plates; and in the panels of car and carriage bodies. advantages of aluminium in the The known; among these advantages are long life, non-corresion from acids, and lightness.

In the form of powder aluminium is used to an increased extent in the manufacture of metallic paints and varnishes, its property of not tarnishing making it particularly suitable for this purpose. The paint is valuable in protecting iron

The paint is valuable in protecting from and in rendering woodwork partly fixproof when applied in thiele coats. In the form of tubes it is used by sold and rubber manufacturers. A new product is bimetallic tabing, which is made of aluminium and steel, with the other sheet of aluminium and the finner of steel, or ofce evers. The seams combination may be made with aluminium and comper.

strangth of he able teature able features of the alloy which it can be turned, pl

Logal Notes

Polerany 20th, 1910, is in According to mathematics as taught in the little red school house, I day equals 24 hours, but for defendants in the e of McGinsey v. State and Nob State, 132 Southwestern Repor day equain 41 years for McGinsey and 40 years for Nobles. So sutherities dif-40 years for Nobles. So sutherities dif-for. They were such contribled for reb-bary, and given, respectively, 40 and 41 years in the pentiumitary; but, because the uan who drew up the indeferment had not committed to memory the jild chase. "Thirty days bank September," etc., they appeal, for the indeferment alleges the or-fennes to have been commented on Feb-ruary 19th, 1910. The Court of Criminal Appeals of Terms holds that this is an impossible date, and is not a sufficient allegation of time to comply with the allegation of time to comply with the statute, which requires that there shall be some particular data mentioned. prosecutions were dismissed.

X-ray Bridence -- According West Publishing Company's "Docket," a new use has been found for the X-ray machine. In the case of Browder v. Com-monwealth, 123 Southwestern Reporer, 328, it seems a negro was on trial for shooting and killing a white man. He did not deny the shooting, but claimed he shot in self-defense. The deceased after the shooting had a pistol. Defendant claimed that he had been shot in the breast by deceased, which was the be-ginning of the difficulty. It would neces-sarily follow that if defendant was shot, and if he could affirmatively prove it, then a case of self-defense would be clearly established. Accused moved for a continuance in order that he might be examined with the X-ray by a physician to show that he was shot in the breast and that the bullet had lodged in The court on appeal held that defendant on return of the case might be taken from jail to an X-ray machine and examined; for this fact, if proved, would strengthen his testimony as to what occurred at the time of the homi-

The Spearmint Trade Mark in Court. In the case of William Wrigley, Jr., v. Grove Co., 183 Federal Revorter, 99, It was decided that the word "Spes applied to chewing gum, was a term descriptive of flavor, open to every manu-facturer who used such flavor, and cannot be appropriated as a trade me not be appropriated as a trade mark. The Wrigley Company for at least five years has been selling this gum, which has become popular through advertising. The defendant company lately placed upon the market a similar gum called "Spearmint," imitating the other's la-bels and boxes, and thus secured a portion of the profit from the vast des for "Spearmint" gum. An injuncti prayed for. The Circuit Court of New York held that, although complainants were not entitled to a trade mark in the rord "Spearmint," defendants in imitating the cartens and packages chargeable with willful and inten unfair competition. This may have be a blow to defendants, but the iron h of the law strikes many more, for the court says: "It is well known that the gum-chewing community is not, as a class, drawn from the most intelligent and discorning portion of the public. The proof shows that in the city of New York

SCIENTIFIC AMERICAN

with well revolt and cry out as the most un-control with was the most un-control all." An injunction was

The Passantic Tire in 1867.—An early instance of the pneumatic tire is found in a United States patent issued May 8th, 1847, to one Thomson, of Adelphi County of Middlesex, England. To an or county or minusees, anguind. To an or-dinary wheel he added what he terms a best including an inner casing of canvas saturated with rubber and sulphurised, and a strong outer casing. The tire was preferably distended with air, through a pips fitted with an air-tight screw cap, filling tube of the ordinary pneumatic tire of to-day with the tube extending inwardly through the wheel felloe. that early day Thomson suggested that the belt or tire might be distended with allic spring, sulphurised pieces of stchouc, horse hair, or sponge. He describes a wheel having a series cluster of smaller circumferential tubes inclosed in an outer casing. As r modification he describes and illustrates a tire in which the tube is divided transversely with a number of separate air-tight compartments, each ion having its own individual filling tube. In mentioning the advantages of his construction, Thomson referred to the small amount of power requisite to propel a vehicle equipped with the pneu-matic tires, the absence of joiting and consequent lessening of injury to ma-chines, absence of noise, high speed at-tainable and gentle motion resulting from the use of the new construction.

A Patent Lawyer's Eloquence.—In one of the telephone cases back in the eighties Mr. Edward N. Dickerson, of counsel for the company and one of the patent attorneys of his day or any day, delivered an interesting argument, the printed record of which covers over two hundred pages and is as read-

Referring to one of the opposing counsel, he says:

"There is a maxim among the Ori-"To know that you know you know: and to know that you do not know what you do not know, that is knowledge.' My distinguished friend ntly studied that maxim with care; and he has made great progress in the latter half of it. He knows that he es not know a great deal; and if he should in the future make equal progress in the former half of it, he will be able to present himself as the embodiment of knowledge. But thus far he has not studied that; and whenever he departed from the safe negative side he made a mistake. With the liberality which belongs to a generous nature, he did not wish to deprive anybody else of a share of the happiness of ignorance: for he told you that none of the rest of them know any better than he did, which at least was generous to them."

At one point he pays this eloquent tribute to invention and inventors:

"A century had passed since this country was a wilderness; and it had become a garden, inhabited by fifty millions of people, whose success and prosperity had depended upon the inventive genius of man. The few feeble hands that came to these shores were reinforced and had become millious because of the strength given to them by the inventions that the men of genius had furnished them-ins which never would have been made but for the encouraging influence some our roy the encouraging innuence of the paster laws. The great prairies of the West which, when they are tickind, smile with a ripple of golden grain, swee made to smile ten times there were the McCormic reaper. The make reduct of the worthess cot-pin giast had been coined this gold—NRINO. It is claimed that by this corrected has delicate hardress and into process a considerable saving it effected the makes shirt, the great civiling of both in the heat required to drive of the makes shirt, the great civiling of both in the heat required to drive of the makes shirt of Whitney and of the ammonia from the solution and in the cooling water for the condense.

A Control of the Cont

Notes for Inventors

The "Pulmotor."—There has recently seen on exhibition in the office of Dr. J. A. Holmes, Director of the Bureau of Mines, an apparatus of German origin called a Pulmotor It is designed for in resuscitating persons whose lungs have been filled with noxious gases or water. Wonderful results are credited to it, an instance being cited where three i who had been repeatedly passed upon as dead were restored by its use, and in another case the Pulmotor did not reach the scene of a terrific mine explosion until twenty-six hours after the accident, and still was successfully used to save a man found near the mouth of the mine and who showed only slight bodily warmth.

The Flying Machine in Agriculture. -chine as an aid to agricultural nursuits is claimed for Thomas Hitchcock, a farmer in the vicinity of Alken, S. C., who was recently carried by Aviator Coffyn in a flying machine from Aiken to his planta tion, about sixteen miles away, and after attending to the business requiring his attention, returned in the same manner

A Queer Use for Concrete. -- A some what novel use for reinforced concrete is found in a French patent of July 24th, 1906, which employs the medium in pro-ducing a tire for wheels The patentee claims that it presents a very hard surface and has a resiliency about equal to that of steel.

Vacuum Cleaning, an Old Idea. —It is not unusual for a rapid commercial devel opment of an art to follow a long period of quiescence, and in few cases is this illustrated better than in the vacuum carpet cleaners, so popular at this time. More than fifty years ago a patent was granted to Daniel Hess of West Union, lows, for a carpet sweeper in which as it is rolled over the floor a bellows operates to create suction, draw dust up from the carpet and discharge it into pans of water, the bellows being worked from a on one of the supporting rollers. More interesting, in view of recent developments in the hand operated vacuum cleaners, is that shown in a patent issued in 1869. This cleaner closely re-sembles those marketed to-day in that it has a broad flat nozzie to move along the floor, a handle extending up to be grasped by one of the operator's hands, while the other hand turns a drive pulley geared by a rope with a fan which sucks the dust up into a receptacle carried by th handle above the fan. A machine follow-ing this plan of more than forty years ago, if well made mechanically, would present a good appearance alongside of modern machines. and doubtless would give good results in actual use

A New Process of Refrigeration. -- Improvements in refrigeration, which are of especial interest to chemists, form the subject of a number of patents to W w Seav of San Francisco Two papers on the subject were read before the American Chemical Society at its December 1910, meeting at Milwaukee In carrying out the process the expanded ammonia gas is combined after refrigeration, with two bodies of a solid absorbent contained in separate tanks, a portion of the am-monia being heated and volatilised from the solution under compression in the first tank, and the gas delivered into a condenser, the other tank being cooler and under low pressure and the residue of the ammonia from the solution in the first tank being delivered into the said second cooler tank and the process reversed similarly to the process followed when liquid absorbents are used in sep arate tanks. The solid absorbent specified is such as sulpho-cyanide of ammonium-NH,CNS-or ammonium nitrate

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The offices are inserted by special arrangement ith the inventors. Terms on application to the devertising Department of the SCINNTIFIC.

The weekly Index of Patente issued by the United States Patent Office will be found in the Scientific American Supplement.

rtaining to Apparel.

Pertaining to Apparel.

SWEAT BAND FOR HARN-B. Z. SMITH,
Mountain Home, Idaho. The object of this invention is to provide a tand, sepecially adapted for mea's bats of any type, which will permit the top of the head to be ventilized, and
will not abut off the flow of blood to the scalp,
the band engaging the head at a number of
separated points, instead of in a continuous
band

Electrical Davices

ALTERNATING CURRENT PLANT COM BINED WITH STORAGE HATTERY.— I. RORMORS and A MELASE, HEID, GETABLE, RORMORS and A MELASE, HEID, GETABLE, THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PLANT COMPANY OF THE PROPERTY OF THE PROPERTY OF THE PLANT COMPANY OF THE PROPERTY OF THE PROPERTY

Of Interest to Farmers

Of Interest to Farmers,
COTTON GIOPPER—J J, Coop, El Paso
COMIN, Tozas. The invention provides a colton chopper adapted to be used to cultivate the
sail previous to planting cotton on the like, or
the device can be readily used to chep dean
rows of cotton stalks or the like, the means for
chapping off the stalks being adoutable so that
the stalks can be severed at various distances
above the ground

above the ground at various distances above the ground as NERIHI E. S. Blazon, Erie, III. The board separating the broad chamber from the supersis provided with a supplemental bre-passage which may be instantly operated extendry to the hive. The other be-passage with which must be hive the other be-passage with which must exparating tour dispersion of the original provided in abor furnished completely closing this senge of here or for completely closing the same as conditions results.

solve.

VERMIN EXTERMINATOR FOR IVOIL
TRET.—W. F. CRAWMEN, Colorado, Texas. The
apparatus includes a cup—or con—like holder
apparatus includes a cup—or con—like holder
clude, as perforated conveyor into and from
which the light is addirect, and an throus distributor with which fowlis come in contact as
they gues in or out. The liquid holder is prelinto the conveyor, and the distributor is prefersuly formed of cettin strands that are hung
from a pivoted rocking device in which they
are clamped.

Of General Interest.

Of General Interest,
COLLAPSHIDE FUNNEL.—A L. Hannibu
row, Hooker, Okla. This funnel is adapted for
conducting various materfals, the same being
formed of telewopic paris, so that it may be
adjusted to occupy minimum space for storage
or transport. It is provided with an attach
ment in the form of a skin or faster suitable
for ditering liquids, whereby the funnel is patticularly adapted for use in straining assoline
or other liquid hydro-action used in motor
vehicles.

webteles.

FILLING DEVICE.—F. WENDLING, New York, N. Y. In the present patent the luven tion has reference to device for silling liquid into kegs, barrels and other receptacles, and the object is the protision of a new and improved silling device, arranged to give an siarm or to shut off the supply of liquid as soon as the receptacle is properly illing.

the receptacle is properly filled WATER DIFFILIUM, SYSTEM—H E MARTH, Colorado Springs, Colo The invertion provides a means whereby water may be raised from a well or other receptacle without necessitating the employment of a pump in a well; to provide means whereby the slow of water may be centrolled to produce instantaneous effects as when influenced by a water bead.

trasion on the spring bolt is obtained by a threat in usial alignment therewith, instead of a thust at the side or oblige thereto, as a thust at the side or oblige thereto, the fitting bolts that the side of the side of the fitting bolts that the side of the side of the fitting bolts that the side of the side of the fitting bolts that the side of the side of the fitting bolts that the side of the side of the fitting bolts that the side of the side of the fitting that the side of the side of the fitting that the side of the side of the side of the the side of the positions.

orditions. However, and the description of the engineering shows a dector which he ruse for closures such at dense, to retain a over it a destret position. For this purpose we be made of a cashing for attachment to a soor, a plunger mounted to side in the ensuling and adapted to extend therefrom, a pawer for



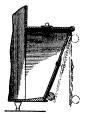
DOOR CHECK

engaring with the plunger to retain the same in the casing, a spring for moving an end of the plunger outwirdly from the casing when the pass is released from the plunger, a red Born; ped secured to the lattice and of the plunger, means for limiting the inward move ment of the plunger and a goard plate for a reclusive to the casing to prevent injury to the closure by the plunger.

Heating and I ighting.

Heating and Lighting.
FFRANCE DIACT O'BERTNIN: APPARATTIS—W. H. SCHURER, N. W. York, N. Y.
The Invector provides an apparatus for opening and cloding dampies of a furnace and a
time actuated mechanism for clouding the
same; provides a time actuated mechanism for
relessing unlined bedvier for opening and clos
ing the dampier drafts of a furnace having a
tulping mechanism shipplified in its operation, to
tulping mechanism shipplified in its operation,
and the provided of the convenience of the releading mechanism in convenience pottion upon
a furnace. a furnace

a furnace
DAMPER JAMES M SERRORS and GRORK
W POUTSONN, IN: Obeyon I in the prosent
patient the Invention has reference to draft
regulators and more particularly to dampers
for furnace and the like as shown in the accompanying illustration, and has for an object
to provide a damper adapted to automatically



DAMPER FOR FURNACES

regulate the draft for a furnace or a store. For the purpose mentioned use is made by the intentor, Mr Fogelsong, of a closure dependent from a kuffe edge, and means on the closure for adjusting the unjet of dependence of the closure or for removality securing the closure to a flue or like member.

Hardware and Tools,

WITERII, TAPE MEASURES—R. G. SHITT,

WATER, T. The object of the avendion
the required length of the draw out, pretune on winding tape measures, which will hedd
to be required length of tape draw out,
pretwenting fits return, and also preventing the
the heads first the same has been shiped to
withdrawal or now line smitt released. The
ingrerement map be spined to return
the most fits the same has been shiped to
string the state of the draw out,
prewithing the return, and also preventing the
ingrerement map be spined to return
STREPCHINO ATPHARTHE.—C. J. GARRIS,
MORTISTON, ATPHARTMENT, ATPHARTMENT, ATPHARTMENT,
MORTISTON, ATPHARTMENT, ATPHARTMENT,
MORTISTON, ATPHARTMENT,
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MORTISTON, ATPHARTMENT,
MORTISTON,
MOR

BALANCING GEAR FOR AIRSHIPS.—H. M. Indiana, Camden, N. J. The favention provides means operable by the aviator for satisfus the wing flexure of aerophanes; provides means for avaring the extent of the facture and for connecting the same with the tiller device; and provides means for adapting the wing waiting flexure or allerons to the operation of the storing radder

GRINDER ATTACHMENT .-- J. M. JEREN and & C Leitlanc, Bowle, La. The improve-ment provides an adjustable, spring-actuated tension device to relieve the pressure on the grinding wheel when the same exceeds the calgrinding which when the same exceeds the car constell strain and provides a tension device for the mandrel of the grinder head which is simple, efficient and durable in construction.

ATTUMATUL MAPPING MACHINE-MOR ATTUMATUL MAPPING MACHINE-MOR ATTUMATUL MAPPING MACHINE-MOR DEAD OF THE MAPPING MACHINE-MOR BUT AND A MACHINE-MORE BUT AND A MACHINE-MORE PERSONAL MACHINE-MORE AND A MACHINE-MORE MACH



AUTOMATIC MAPPING MACHINE.

junction with a bicycle, automobile, or other vehicle, if the same turns with the wheel, is fixedly mounted one of a pair of gears, equal or different in the number of teeth carried thereby, as desired

INTERMITTENT DRIVING MECHANISM. ANTON E. H. J. THOULDING, 100 FOSTER ST., New Haven, Conn. In the present patent the invention shown in the accompanying sugraving is an improvement in intermittent driving mechanisms for use in machines in general, and it has in view a rotary driving member



INTERMITTENT DRIVING MECHANISM

d a rotary driven and a rotary driven member mounted closely adjacent with the driving member having a driving dog pivoted thereto to swing into an agagement with the driven member, and a mechanism to look the dog to operative position, respectively released from and engaged with the dog at predefermined periods by ladependent devices.

WITH the date of the contract of the contract

of the molten metal therein contained LHOM SHIPTLE.—W. H. WILSON, New Bedford, Mass. More particularly the inven-tion relates to the construction of the thread-enzaring and delivering portions of the short-ie Mr. Whon's improvement is applicable to the ordinary type of shuttle in which a bol-bin is supported within an operating in the body or tigs shuttle so as to deliver the thread of

the end of the bobbin and through a delivery ope in the side of the shuttle.

eye in the side of the shuttle.

TRAP.—L. C. ACCOLA, In Grange, Mo. The
invention relates more particularly to mechanical traps and provides a quick-operating mechanical trap for trapplug animals, particularly quadrupoda. For the purpose ensationed,
use is made of a coiled wire spring having
reads extended from the spring and recessed, one
over the other, a trigger wire mounted on the
spring and engaging the trigger, and quick
wires engaging the trigger and the crossed ends
at the point of crossing

Bailways and Their Acce

Ballways and Their Accessories,

RTRIKET CAR PENDIRE, J. J. KRILY, NOW
YOR, N. Y. The principal object of this improvement is stere (as reduced in the provides a mechanism therefor, whereby the fender may be lifted to a position of anticy, under certain conditions of operation of the street cars, and operative or like-accessing position to an operative or like-accessing position of the provided of the provided

to the track in the form of a flat atterm or short. TRUCK —C. A. Lincoln, Wayne, Mc. This invention provides trucks for railway care constructed and arranged to dispose the axies of the where in thereof in radia inposition upon curved sections of a track, and provides means for balancing the weign of the axies of a four-wherd truck when the same are adjusted to track on a curved section of the road bed.

Pertaining to Vehicles.

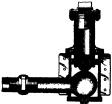
Pertaining to Vehicles.

RHOCK ARRHERE—J. M. Jackson, Parkersburg, W. V. The intended here is to produce a simple, cheen and efficient device which can be applied to any autonobile to act as an the shocks or joils practically negligible when traveling at high speed and under normal conditions of fravel THRE—V. O. MERVINS, Stroudsburg, Pa. This invention is an improvement on restlient similar vehicles A feature He in the risk being arranged diagonally to the circumference of the tire and the treed surfaces and the spaces intervening the risk are curved, with the lines of the recesses and of the risk arranged diagonally to the circumference of the tire and the treed surfaces and the innes of the recesses and of the risk arranged circumstance and avoiding angies that cause fracture of the rubber by the flexion of the ribs. WHERI.—V. O. MENNINS, Rivoudsburg, Pa. This invention is an improvement in wheal for us on autonobiles and similar vehicles. Menap provide for holding the tire when it is moded in the carrier, it will be flruly held thereto as a against strains in valous directions and as are experted ordinarily upon automobile whoels in the operation of such machine. The the use of the tire with the minimum weaken ing effect upon the tire.

VERICUE SPRING.—Caston Recatavarx, and Jose P. PRING.—Caston Recatavarx, and Jose P. PRING.—Caston Recatavarx, and Jose P. PRING.—Caston Recatavarx.

lag effect upon the tire.

VEHICLE SPRING, --Casion Escalarre, and Jone P Bringano, 324 West 23rd St., New York, N Y. Tho object of the invention linearized between the provide a presmatic syring for connection with being the spring for connection with being the spring produced to the spring produced the spring spring to spring spring the spring now used by gride, replicating now used by



stacles; to considerably diminish the height of the displacements transmitted to the high of

stacles; to considerably diminish the begint of the ship of the sh

unnecessary friction.
TIRE.—W. D. FUREN, Norfolk, Va. The ed-ject of the present lawention is the provision of an inexpensive resilient tire for use in some mobiles and like vehicles, which will clearly re-smith the puermatic tire and provide a suffi-cient degree of realizinty without any possibil-ity of damage from pusetture.

DEBIGN FOR A TOY FIGURE OR LIKE ARTICLE.—COMMILIA A. HOPKINA, New York, N.Y. This commental design for a try figure is particularly attractive from its grotesque construction of form and features and ornamentation in super sectualized. The design mentation is super sectualized, The design and extensively. The design and extensively the design in the commentation of the commentation o attention.

NOTE.—Copies of any of these patents will be furnished by the Buisnitzia American for an entis each Please state the name of the patentee, title of the invention, and date of this paper.



Kindly keep your ourries on separate absets of paper when corresponding about such maintenance and another plants, books, etc. This will greatly facilitate answering your questions of the partial plants of the partial plants are should be given on every sierer. No attention will be paid to unasigned queries. Full thinks to correspondents are printed from time to time and will be paid to making the partial of correspondents are printed from time to time and will be mailed on required.

(12419) E. C. M. asks: Will the mode (12419) E. C. M. anker: Will the mode of cleaning silver in Query 2205a affect plated eliverator and cut off the plate? It is a simple way of cleaning it said and not injuried at the control of cleaning the control of cleaning the control of cleaning silver removes a layer of infanishment thickness cach time it is employed, but no also does the use of any pollab by robbing. It the boiling is not prolonged beyond the control of the contro

(12420) A Subscriber since 1860 writes: (12420) A Subscriber since 1860 writes: To get a tight over of a round the bax-of backing, tooth powder, totaccu, and the like-do not touch the cever, but tag on the side of the box Itsalf close to the cover with a small sammer or the equivalent, soing round and round. By the second or third time round the cover will be loose enough to fail off. It is rather curious to watch it rising as you turn of as a curious to watch it rising as you turn out as a curious to watch it rising as you turn out as a curious to watch it rising as you turn

VEHICLE SPRING.—Cators Reclaims, and Jose P. Singaro, 22 West 23rd St., New York, N. Y. Tho object of the inverted in linear travel have an processing the provider a presentation of the reverted to the provider and the provider of the reverted to the provider of the provider of the reverted to the provider of the reverted to the reverted to the provider of the reverted to the reverted to the provider of the reverted to the provider of the provider of the reverted to the provider of the provider of the reverted to the reverted to the provider of the reverted to the reverted to the provider of the reverted to the provider of the reverted to the reverted to the reverted to the provider of the reverted to the reverted

mattest beigt of wises in the section of the sectio

(1948) T. J. M. asku: Please expining in the how much water will pass through a straight 1-46n-cattrion water pipe in 24 hours, with a pressure of 100 peausis. A. The law of flow of water in pipes is very which expresses it One of the best approximations is Katter's formula, which needs the categories of the confidence of the confidence of the confidence. When the confidence of reaghness is cerebilly selected, the result colculated from the formula will be probably not called the confidence of reaghness is cerebilly selected, the result colculated from the coronia will be probably not called to make the calculation, not knowing length of pipe or its condition as to surface, joints, straightness, etc. If the pipe were a short elsewer, may a fout long, yeu could use the simple formula of 22 ph which in this case is the same of the confidence of the (19423) T. J. M. asks: Please expinis

× 24 . 5,160,000 cubic feet per 24 hours through the short 10-inch sleeve or nozsle.

through the short 10-inch sheere or nonies. (12424) M. W. D. anks: We have two hollers. 125 hyper-power each, carrying from 60 to 80 pounds pressure for heating purposes. Our feed water is cold. If we tap the feed plips and pair to lives steam at holler pressure to heat the water will it effect a saving of speaking. In heating from water by live around from the holler. Homestimes feed water contains impurities of a nature which will be deposited when the water is heated shove 212 degrees, and live steam any time is used to advantage to parify the feed water and cause of the third of the same that the same that the same and the same that the same and the same and return all the hot water drups from the rather the same that only such as yours, the only possible commonly in fuel water is to sare and return all the hot water drups from the rathers. Feeding end water hot a hot boiler should only be done in such a way as to precontact with the hot bolier abent, with the consequent audden and unequal contraction of those sheets, straining rivets about joints, other causing leaks and even cracks, and tending to deposit seaks and even cracks, and tending to deposit seaks and mud and cause overheating of the nextla so covered. (12424) M. W. D. asks: We have two

(12425) J. W. B. asks: I would be

when the property of the earth attraces with the control of the co

(15427) R. X. says: A circular reservoire is 00 feet in diameter, 15 feet deep, built of stares, encircled by a single hoop at one-third or thereason of their height, the point where the pressure above and below will be open. The task is filled with water, and the close buseting strate, is sentiated by the one loop? Also, what will be the artsul if the task is 50 feet losted of 100 feet in diameter? A. Imagine shaft the dismeter of the task to be sitted with a solid block of wood or anything piles. The pressure against this block will be sentiated by the sentiate of the control of the sentiate of the control of the sentiate of the control of the sentiate of the task to be sitted with a solid block of wood or anything piles. The pressure against this block will be sentiated by the sentiate of the sentiat

or 2.6 pounds per square inch Hed by the area of the face of the 100×6 square feet or 86,400 square

inches.

88,400 × 2.6 = 224,040 pounds.

Half of this pressure will fall upon each side of the tank, or the rod securing the staves, which must therefore be strong enough to withstand 118,530 pounds strain. If the tank is half as large, the strain will widecutly he

(1343) W. B. G. asks: Why is it got presible to cury on an simily a sowerful compressor, and compress the gas the drains set fags as it is expanded by the heat of the sun I During the night it could be allowed to five from the drains back into the balloon, thus avoiding the waste of either gas or ballast. A. We sugged you calculate the weight of compressor and gas drains, and considers the allowed the compressor and gas drains, and considers the already limited carrying capacity for passengers and their belongings. A cubic foot of sir weighs about \$1.000 pound, so that 100 retite feet of all, It compressed to 10 atmospheres or 135 pensels gave pressure, would occupy 10 cubic feet and weigh 6 prounds, and a vylinder miglightle weight to carry on the simble. Balloon gas weighs somewhat less than sir, but not crough to make its transportation in compressor. (12428) W. B. G. asks: Why is it mot

compressor.

(1948) W. C. G. says: I have often noticed when draining a resent of water, where the drain is in the bottom and near the center of the vessel, the water stars to revolve interest of the vessel, the water stars to revolve interest of the vessel, the water stars to revolve interest of the vessel should be being clockwise, or to the right lavarishly. It is more marked if the vessel shope at the bottom. Is this die to magnetic lines of force? If so, our earth mast be a hape dynamo. A we have freduced that in a weak basic a rotary motion is always produced in the water as it runs out at the hole in the unidate of the bottom, and that the motion is always clockwise. We are not take to subscribe to the "always." since we and also when the rotettion of the water was contra-lockwise motion is due to the rotation of the earth upon its axis, as is the case in the mention of rotetion is due to the rotation of the centre of the rotation of the centre of the reserved out from the center, as in centrifugal motion. There is nothing magnetic about this phenomenon, although the carth may be a great dynamo. Water is not a magnetic material, and has no unsceptibility to magnetic for the center of the contract of the center of the cent (12429) W. C. G. says: I have often

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NEW BOOKS, RTC.

FEAM TURNINGS. Their Design and Con-struction. By Rankin Kennedy. New York: The Macmillan Campany, 1910. 8vo.; 104 pp. \$1.25 net.

struction. By Rankin Kennedy. New York: The Monculian Company, 1910.

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STRUCTURE A COLUMNYS AND THEM COAPPES.

Cond. 8 Hades—Impulse Wheels and Resculed Wheels—Brush Parsons Turbines—Wheels—Brush Parsons—Brush Par

tion, power transmission, and similar subjects are discussed in detail, with the addition of a chapter on classifity and atreas of materials Much apace is devoted to problema, in the conviction that carefully selected problems are in the highest degree illustrative and calight ening

A Systematic Explonation of the Normal Keel-Jear. By Raymond Dodge, Ph.D. (Reprint from Zeitschrift für Allgemeine Physiologie). Jena: Gus tav Fischer, 1910.

Allgemeine Physiologie). Jona: Gus tav Pischer, 1910.

A sharp tap given to the tendon of the nuscle in which the know-rap is loaded produces the well-known "know-jork," a phenomenon which is extracted in mode of an a disciplant of the modern state of the product of the modern state of some dispute. Some doubt has been expressed as to list rune roke, partly owing to its clinical value, but also on purely selven tific grounds in the care to some doubt has been expressed as to list rune roke, character, I e. a native of some dispute. Some doubt has been expressed as to list rune roke, character, I e. of the care of some dispute to some have malestained that the entire action arises within he muscle lette! Thus the "seculidate that roke" or knew-jerk forms from several points of view an interesting subject for study. The model care to the seculidate of the work of the subject of the sub

Industrial Accidents and Their Compensation By G. L. Campbell. New York: Houghton Mifflin Company, 1911. Small 8vo; 105 pp Hart, Schaffner and Marx Prize Essay

to be well qualified to fulfil the claims ex-pressed in the preface by the author, when he size is the hope of the writer, however, that its very hereits will commend this little book to many persons who, larking the time for con-sulting a large number of public reports and other isources, desure a general knowledge of the problem presented.

the problem presented "
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375 pp: 422 Illustrations Price, \$2 net.

As the work is intended for the beginner in less than for the practical man throe biffers a statement of general principles and law, illustrated by smaller experiences. But the statement of general principles and law, illustrated by smaller expensions. But terries expensions. But terries expensions to the terries expension of the terries expension of NYT RECTLIFICAL ANGLE 119 George Goodwin, Ottawa, Canada Copeland-Chatterson-Crain Press, 1910–21 pp.

The solution is based upon the theorem that if the dick of any trimingle be produced, the exterior angle is equal to the two interior and opposition angles.

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Monsters of Bygons Ages

Construct you page 505, or agree 505, or agr

skin, while others wore a casemare armor and bour plates. Bome were wagnetable feeders and others carativerous. The second creature to be erected at Stellingen was a representation of the dipiodeous. It measures some 65 feet the skeleton in the American Massum of Natural Hattory with the feash on. It will be recalled that this particular skeleton was obtained in 1998, from the famous Bone Cabin Quarry, in Central Wyoming—a veritable graveyard of pre-historic animals and the richest deposit of feath-emains known. Like many other great "finde" it was discovered by accident. In the days when this animal and its fellows were silve, the contry which now comprises Wyoming. Mos-

accident. In the days when this animal and its fellows were alive, the countries and its fellow were alive, the control of the countries of the countries. According to the countries of the coun tion. Although the biggest creature that ever walked on four legs it was singular-ly ill-fitted for holding its own in the struggle for existence, and was no doubt killed off by the smaller but more power-fully-built carrivorous dinosaurs of that age. It possessed a very small brain, and even in those early days brain and not bulk counted much in the struggle for existence.

Another strange dinosaur, of which Hagenbeck had made a striking life-like Another strange dinosaur, of which Hagenbeck and made a striking life-like relevant of the stagosaurus so forming a double ridge extending along its back This was one of the mightiest of all dinosaurs. Its length was about 25 feet. Some of the bony plates on its back were as much as a yard in width. Its tall was armed with eight spikes or spines. More than twenty specimess of this interesting monator have been discovered in the Rocky Mountains by the spine of the spine of the Rocky Mountains by the spine of the spine of the Rocky Mountains by the spine of th

this center. The last, and in some ways the strang-est of all the dinosaurs, was the tricera-tops, whose remains have been found in the cretaceous strata of the Rocky Mounthe cretaceous strata of the Rocky Moun-tains. At Sicilingen two full-size repre-sentations of this wonderful creature have been erected, one partially sub-merged in the lake and the other stand-ing upon the bank, as well as a baby triceratops. The full-grown figures are about twenty-fue feet each in length as Skulis of this animal which have been uncarthed in the Rocky Mountains have measured over seven feet in length.

unearhed in the Rocky Mountains have measured over seven feet in length. The most remarkable feature about this creature is the unique way in which the bones forming the back of the skull are developed into a great collar or fringer, the back of the skull are developed into a great collar or fringer, the back of the skull is also a considerable to the construction of the skull is also a considerable to the construction of the skull is also a construction of the day it carried three borns upon its face and with its collar of formidable spines it must have presented a terrible appearance. Its brain, however, was extremely small. Prof. March is of the opinion that this species became too "specialized" and died out—the usual end of a too great ambition! There are other specimes of the disnessure, an interesting representation being that of one of the carrivorous dinosaure, allosaurus, shown in the scot of feeding.

Before the coming of the dinosaure.

in a life-size figure of the Fig in a life-diss figure of the Findscongree victor. This beast possessed a king neglet like a serpent, the head of a liting-d the teeth of a crocodite, the ribe of a cluster, loon and the paddies of a whale. It is, however, analier than the whale of ac-day, being some twenty-two facet in length. It probably could swent under water as well as on the surface his when in the latter position could snap up in the latter position could snap up in the latter position could snap up it lived entirely on lies, head, as it lived entirely on lies, being carri-

Altogether, the collection Altogether, the collection includes some thirty of these prehistoric hearts. There are extinct crocodiles and fishes and currious fin-backed lisards. These last have comparatively speaking small bodies and a currius erection down the center of their back like a frill. They center of their back like a frill. They are shown standing on the banks while a few are depicted swimming in the water. Near where these animals have been erected is the new insect house of the park. The outside wall of this structure is composed of artificial houlders through the composed of artificial houlders these have head to be depended in the composition of the com

Public Roads

I NSTRUCTION in the methods of road building has continued through the medium of object-lesson roads, built at local expense, under the supervision of an engineer of the Office of Public an engineer of the Office of Public Roads. More than one million squire yards of road, equivalent to shout 14 miles of road, equivalent to shout 14 miles of road 15 feet wide, were com-pleted during the year. Viewed as a con-struction record alone this would consti-tute an excellent showing, but when it is considered that this milesgy was made up of 16 object-lesson roads, each consti-tute of the constitution of the con-tinuation, it must be evident that this feature of the department's work is a powerful factor in the promotion of the movement for the betterment of the pub-lic roads.

An inspection last year of twenty-two object-lesson roads, aggregating about objecticeson roads, aggregating about twenty-two miles, showed that their effect upon the different localities had resulted in the building of 750 miles of additional roads according to the same methods, and had brought about the expenditure, through bond issues, of \$1,000,00.

000. Advisory work relating to road prob-lems necessitated about 250 assignments for the department's consulting engineers and experts. This was an increase of about 70 per cent over the amount of like work performed during the preceding fiscal year.

Irrigation Investigations

Irrigation Investigations
IPVHE Office of Experiment Station has
I endeavored to aniarge its plans to
meet the demands for information. In
the past, water for irrigation purposes
was plentiful, and in the old-school
method of use great quantities were
wasted. In many parts of the West this
old method still prevails, but the improved principle of irrigation advocated
by the department is rapidly dispiscing
those of former days, and good results are, noticeable. When the irrigators of
the San Joaquit Valley first beean irright bean irright bean irright the San Joaquit Valley first bean irright the san irright the san irright the san irright bean irright the san irright bean irright the san irright the san irright the san irright bean irright the san irrigh by the department is rapidly displacing those of former days, and good results are noticeable. When the irrigators of the San Joaquil Valley first began irrigation they used over nine feet. About one-third of this is found to be simple. The water of the information of the second compared to the se

irresuing representation being that of one of the carrivorous dinosure, alloesure, abown in the act of feeding.

Before the coming of the dinosures before the coming of the dinosures in the world was populated with those lake Mr. Occil Grate (who was creatures, the pleedesurians or while fiving the channel). Gold modal, and half rotile. One of these has right-in the Gordon Sensition, the control of the unique carrian media, Mr. Graham-White, for his victory in and half rotile. One of these has right-in the Gordon Sensition, the Gordon Sensition of prehabencer with-the act Sentiments, from Sensition of the Sensition of prehabencer with-the act Sentiments, from Sensition Sensition and Sensition of the Sensition of prehabencer with-the act Sentiments.





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Embryology?



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supy. Second Oress-country Philiphie in Germany.—On March 28th Lieut, Spine flow with a passenger from the Doebertis aviation field near Berlin, to Hamburg, a distance of 18th Unites 18th, hours. This is the longest cross-country faint ever in the longest cross-country faint ever in the longest cross-country faint ever in the longest cross-country faint ever to the longest countries of his journey to Rysmen. He covered this second stage at a rate of 07 miles an hour according at Rysmen. He covered this second stage it a rate of 57 miles an hour according to the cable report; and on March 30th he-continued the trip to Hanover. This excellent series of flights by a military aviator shows that Germany is catching tip to France in the field of military asymmutically.

seronautica. Need of a Compass.—How great is the need for a magnetic compass that shall remain unaffected by engine vibration of an aeroplane was forcibly brought home by the sad gate of Ceeli Grace. The problem is now receiving serious attengion. One of the Brookland systors, Mr. Duerocc, is using an interesting compass tent to him for trial by a naval officer, who has employed it with success in submarties work. It consists of the usual tent of the control of the motor.

ceitest procession against the vipration of the motor.

End of the Wright Suit is Prence.—
A suit of the Prench Wright Co. against Blériot and other leading French constructors was brought to as ead on Barch 30th by the summing up of the structors was brought to as ead on Barch 30th by the summing up of the last the Wrights had not established an infringement, while, on the other hand, the derindants had failed to invalidate the patent. It is expected that the decision will be handed down on the 39th instant. Wilbur Wright was present and testified in person. His bother, Orville, who remained at home, is said to be experimenting at the present time with an automatic stability device which will render the brother's biplanes more easily controlled and more safely operated.

Estimated Rese for the Bennett Arises

Elimination Race for the Bennett Avia-tion Trephy,—Belmont Park has been turned over to the Aero Club of America by its owner and the executive committee of the club has set the dates of May 19th, 20th, and 21st for the elimination race to select representatives of this country on the team which will be sent to England the team which will be sent to England in the endeavor to regain the trophy captured last full by C. Grahame-White. Mr. Rebert F. Collier has put up a \$5,000 cup for the winner of the elimination race. The committee reserves the right to appoint other aviators, for example, Mesers. Martin and Woyman, who are frying abroad, in case it seems probable that of the colling and the col race in England has be June 188th to July 1st.

Electricity

The Navy Wireless Telegraph Station.—It was recently announced that the high-powered wireless telegraph station of the Navy Department is to be located of the Navy Department is to be located on the southwest corner of the Fort Myer reservation. Here a number of towars, 460 feet high, will be erected, for the purpose of supporting the antennae. They will be arreafined either in a triangle or a quadrangle. The affective hands of the station will improbably be a supporting the station will improbably be a supporting the station will improbably be to the station will improbably be to the station will improbably the station will improbably be to the station will improbably be to the station will be supported by the antenna, but owing to public sentiment, the plans were changed.

Swedish Farmer's Power Station.— The farmers in the province of Skane, The farmers a fewer Station.—
The farmers in the province of Skane, Sweden, have organized to build a central station to furnish their farms with electric current. This will be used mainly to take the place of mechanical power on the farm, but also for lighting as well. In another section of Sweden, the farmers have organized a company which will buy current from a power station, and distribute it to the various farms. The power is purchased at Ji, cents per kilowatt hour, and is sold for 5½ cents per kilowatt hour, and is sold for 5½ cents per kilowatt hour, and is sold for 5½ cents per kilowatt hour. The stock of this company is divided among the farmers in proportion to the amount of energy they use.

Electricity in Jadian Mills.—The mills.

in proportion to the amount of the way are fiven by seen in Bombay are driven by stoam power largely at present, and this proves to be the property of the pro

No Secret Telegraphy.—Many persons are of the impression that wireless telegraphy is particularly subject to "apply," but, as has been pointed out by Marcont and others, no telegraph system Marconi and others, no telegraph system is absolutely secret. Any one familiar with the Morse code can read ordinary messages entering any telegraph office. At Poldbu, on a telephome connected to a long horizontal wire, the message passing on a government telegraph line a quarter of a mile away can be distinctly read. It has been shown that it is postured to the second of the s

phones in Idverpool.

Ball Lighthing Due to a Bend in a Conductor.—Ball Lighthing was observed at La Rochelle, France, on December 15th last, under the following eurious circumstances (as described in Cosmon): An ordinary lighting discharge struck the antenna of a Turpsin thunderstorm-recorder (ceraunograph). The antenna, which consisted of 2-millimeter copper wire, and had a total length of 100 meters, was attached to a factory chimney; at a certain point it bent at a sharp angle (25 degrees). The lighting volstilised the wire as far down as the bend. Here the discharge divided; part continued to follow the antenna and demolined the thunderstorm-recorder; another rook in Bugirmi has been changed room jame 32th to July 1st.

A Heaver's Cruss-country Flight in Hillied the wire as far down as at the bend. Friends and a stempt to with the Arro Chub-troughy for the quickest flight from late the first the profit of Pari, a distance of over 400. Here the discharge divided; part concluding the state of the state of the same demonstration of the state of the same demonstration of the state of the state of the same demonstration of the state of the state of the same demonstration of the state of the s





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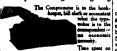








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Engineering.

Motor-driven Warshigs — Octmeny is making a test on a large scale of oil engines for warshige. Three cert of motives machinery, each containing three 3,800 horse-power cylinders, are being manufactured. One set of 6,000 horse-power will be tested on shore. If results are favorable, the three sets, aggregating 18,000 horse-power, will be mounted in a triple-screw protected cruiser. The sextriple-screw protected cruiser. The engines are said to be of the Diesel revers able type.

New Zealand Believes in Ship Sub-sidies.—While the American merchant marine seems to be within measurable distance of extinction, that of other na-tions is being made the subject of gen-erous government assistance. The latest erous government assistance. The latest instance of this is in that enterprising colony, New Zealand, which, in spite of its being to-day the chief exponent of socialism, has recently voted a subsidy of \$100,000 a year for a mall service between Vancouver, Auckland and Sydney.

A New Elswick Fourteen-pounder.—
There is much interest just now in a
fourteen-pounder rapid fire gun, which
has been built and tested by the Elswick has been built and tested by the Elswick firm. The novelty lies in the recoil cylinders, which, in place of the customary springs, are filled with a mixture of liquid and air. In trial tests, the gun has fired ten rounds in succession without relaying. There was no disturbance of the sightling, and five successive shots, it is also discussed in the control of the sightling, and five successive shots, it is and, were placed in exactly the same hole in the built eye

New Railroad Track Scale -The Ponn. New Railroad Track Scale.—The Penn-sylvanta Railroad has installed a scale for weighing cars in motion which is provided with a relieving gear—an ar-rangement of jacks operated by power— which permits the scale mechanism to be completely disconnected from the track, thus allowing the havelet aments to ack. thus allowing the heaviest engine to pass over the scale without registering any weight. The scale is provided with a "mechanical hump," by which it is possi-ble to regulate the velocity at which the cars go onto the scale

Remarkable Trolley Wire Service.—
The New York, New Haven and Hartford
Railway engineers are much pleased with
the durability shown by the new trolley italized entries are much pleased with the durability shown by the new trolley wire of the electric service. One length of this wire, after being in service at the Stamford yards for nearly two years, during which 85,000 locemotive move-ments had taken place below it, showed here a reduction in thickness of the lower half of the wire of only 14 per cent. At this rate, a wire in service on the main line should last for over forty years.

Oil Fuel on an Eastern Railway.-The Oil Puel on an Eastern Railway.—The-New York, New Haven and Hartford Railway is converting twenty-two coal-burning locomotives into oil burners. This change is to be made on the strength of the good results shown in tests which the road has been quietly making for some time past. The Cape train between the South Station, Bos-ton, and Provincetown, has been used for the test, and it is stated that a saving of approximately \$12,00 a day in running expenses has resulted from the change.

British Target Practice.—Although the conditions of target practice have been made more difficult for the gunner, the number of hits has increased in the Pitlish navy. The target, towed at an unknown speed, is 30 feet high by 30 feet long, the latter dimension being less than long, the latter dimension being less than one fifth the length of a modern battle-ship During 1910, the 10 and 12-inch guns averaged 0.7 hits per minute against 0 4 four years ago. The 9.2-inch guns for the whole feet averaged 2.01 hits; the 76-inch gun made 2.81 hits; as against 158 made by this gun four years ago.

158 made by this gun four years ago.

Fast Long distance Railread Run.—A
new four-coupled express plassinger locomotive many for the product of the comotive at
the shope of the product of the control of the control
road Company, recently made the run
from Altoons to Philadelphia, a distance
of 255 miles, in 506 submics. The distance from Altoons to Harrisburg. 151.1
miles, was made in 113 minutes, at the
rate of 68.7 miles per hour, and from
Harrisburg to Philadelphia, 104 miles,
the running time was 95 minutes, at an
average speed of 65.0 miles per hour.
Raduction of speed in the city limits,
Philadelphia, brought down the average,
which, for the entire 235 miles, works
out at 67.4 miles per hour. out at 67.4 miles per hour.

Valuable Suggestion

To our subscribers only

N response to our recent invitation to our subscribers for expressions of their opinions regarding the greater Scientific American we have received many valuable suggestions. All of the letters express approval and satisfaction with the changes made in the magazine and not a few are indicative of a desire on the part of the writers to co-operate with us.

The Scientific American's best friends are its subscribers, and as a result of their enthusiasm we have in the past added many new subscribers to our list. We have, therefore, evolved a plan whereby our subscribers may be benefitted in return for any help they may give us in increasing the circulation of the new Scientific American.

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Glessee

Class Walls in Frate Cultures.—Fruit
culturists abroad have recently essayed
the use of fruit walls of glass instead of
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ecual on both sides of the wall.

Silics Gissa.—Such extremity use has been made during the past few years of silica giase for chemical superatus that it was found necessary to devise a method whereby this giass might be produced in the electric furnace instead of with oxylwiqueen blow pipe. To produce perfectly transparent silica giass from melied quarts an artifice is required, because, on reaching the temperature of 600 deg. C., the quarts splits and minute bubbles of air fill the mass. This can be prevented by first ratising the temperature of 500 deg. C. the quarts gibts and minute bubbles of air fill the mass. This can be prevented by first raising the temperature of the quarts to a point little under 800 degrees and then surrounding it with liquid silica, at a temperature of 2,000 deg C. The liquid silica acts as a shield to prevent the entrance of air when the quarts splits up, and thus the formation of bubbles is avoided

formation of bubbles is avoided to bush of formation of bubbles is avoided.

Keeping the Bee at Work.—The busy little be at the set gets a day of about as seldom as a farmer's boy in haying time but the modern applies that sometime but the modern applies that a self-the se regard them with favor. In results the plan is even better than that of the en-terprising farmer who crossed his bees with fireflies so that they could work nichte

Dr. S. F. Emmons.—Dr. Samuel FrankIn kinnons died on March 18th in Washington at the age of seventy. He was a
graduate of Harvard, and of the Ecole
Imperiale des Mines. He first came into notice for work done in connection with
the United States geological exploration
of the fortieth parallel. His writings on
the science of ore deposits and mountain
building are well known among geologists He has been connected with the
United States Geological Survey since
1879. He was general secretary of the
International Congress, and it svice-president from 1891 to 1903, and treasurer of
the National Academy of Sciences. He
was an honorary member of the Philosophical Society, an Associate Fellow of Dr. S. F. Emmons,-Dr. Samuel Frank was an nonorary memoer of the Fallow of the American Academy of Sciences, an honorary member of the Canadian Mining Institute, a Fellow of the London Geological Society and other geological reanisations

Amundsen in the Antarctic Region Anundeen in the Antarette Region.— Word has been received from Capt. Scott that Amundsen, like himself, is trying to reach the South Pole Scott's ship, the "Terra Nova," has returned to Now Zea-land after landing siedep surties on the ice, and has brought messages from Capt. Scott himself. It seems that Lieut. Pen-nell, of the expedition, found the "Fram." nell, of the expedition, found the "Fram." Anundsen's ship, in Iceland Bay, and a Norwegian party fully equipped for a journey to the South Pole. On board the "Fram." were eight men and sixteen Greenland does. In April, 1999, Anundsen stated that he intended to go to the North Pole. He left Norway ostensibly to travel via Cape Hern and Berling Stratt to the North Pole. An International Strate of the North Pole. On arriving at Madeira in October, he announced that he had changed his plans and was going for the order of the Anundsen's Appellitume patil news was reserved from South Cape.

Salasa (Alasa)

200 Con 190 Co

CONFEDERACY

"Chas. E. Mosby, at the age of 13 years, enlisted a drummer, May 10th, 1861—Elliott Grays, Co. I, 6th BB a diminist, May 10th, 10th Enfort Grays, C.O. 1, 6th Va. Regiment of Infantry''—so reads the record—and that child served in the Confederate army right through the four years of the Civil War. Two companions, being slightly older, were put in the ranks

This picture is one of the 3500 long lost Civil War Photographs that we have just recovered from oblivion, and have put in ten big volumes so that every American can own them.

AN ARMY OF BOYS

Right into history they marched, A threes bright drammer boys of both armies. Only fourteen or fifteen years old, they bore the burden like men, brughtening the long march, cheering the camp and inspiring the discouraged men on the battle line with the crashing heat of their drums. Often, too, they helped the surgeons in the field, and often they grabbed again and plunged into the fight them-selves Just boys! But right in line with their older comrades, they took part in the greatest hattles the world has seen.

When the call to action came, hundreds of theusands of boys, ome of them mere tots, tried to some of them mere tots, fried to enlist in the Union ranks by swear-ing they were over 18 which was the age limit for enlistment. In the the age limit for enlustment. In the Counfederate army, these children swore they were 17 just as cheer-fully. Many of them were taken in as drummers and fifers in the army and as powder monkeys in the many. Some very amusing and pathetic stories are told of these volungaters—one, an infant in year-lust a man in spini, succeeding that the properties of the properties of the anal of thoses, and after cutting patt of tousers, and after cutting them down to ht, pulled on the big coat and presented himself at the enlisting office, ready to do or die. Many of these brave young-sters failed to return when the war sters failed to return when the was was over, and it is pretty sure that some time during those four years they gave up their young lives for the homes they loved so well

We have 1500 photographs that the world has never seen of those two armies and navies. Did you ever hear the story of the taking of these photographs?

ADVENTURES IN THE WAR

Mathew Brady was a great artistphotographer in New York, in the n photography was new. When the war broke out, he went into the fight, armed not with a gun but with the camera. Many were his narrow escapes. Once he wandered for days in the woods, armed only with a broadsword and dreading capture at every moment; once the Confederates mistook his cameras for guns and opened fire on them.

3500 PHOTOGRAPHS

But he stuck to his great task, and when the war ended, he had a supprb collection of thousands of photographs of the men on land and sea, in camp and battlefield, in hospital and prison. Here in these pictures you will see a real war-the greatest war that ever took place on the American continent, and one of the morbiest was of all history. And this is no imaginative artist's handiwork. It is the living impression, caught in the heat of the conflict and preserved on the camera plates, so that it is as clear, as new, as fresh today as it was fifty years ago when this boy slung his drum over his shoulder and beat the strains of "Dixie"

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n a Sears Owner in Hontana.
havedriven my oar 2,500 miles over
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AMERICAN HOMES and

The April number of American Homes and Gardens contains a valuable amount of information for the home-maker. The presentation of a large number of houses showing the best in modern design; the garden and is planning and its appointments; the table and its decorations and furnishings; helps for the house-wife symbolodery; the Late Georgian Furniture by Euber Singleton, of interest to the student of the antique, are a few of the subjects treated in this issue. If Following is a table of contents:

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The Instance Cardon is American.

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Handicratinane-Home. Made Pottery. III.

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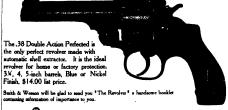
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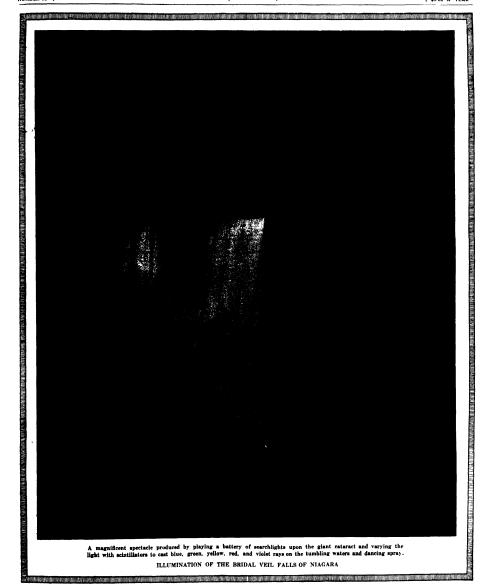
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CIV.]

NEW YORK, APRIL 15, 1911

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SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, APRIL 18, 1911

by Munn & Co., Incorporated. Charles Allen Munn, P

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The Editor is always glad to receive for communication illustraturations on subjects of timely interest. If the photographs are obtained active short, and the facts authorities, the contributions we receive special attention. Accepted articles will be paid for regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasise the inherent charm and fascination of science.

Will the Tungsten Lamp Raise Rates?

HE fear has been expressed that the increasing use of the wonderfully economical tung-sten lamp will so greatly reduce the consump-tion of current as to render it necessary for the lighting companies to raise their rates in order to make a reasonable profit on the smaller output from the lighting stations. A 16-candle-power carbon fila-ment lamp requires 56 watts for its operation, but a ment lamp requires 56 watts for its operation, but a 20-candle-power tungsten lamp demands only 25 watts. This is equivalent to 5½ watts per candle-power for the old as against 1½ watts per candle-power for the new lamp. Hence, for the same amount of illumination in any city, if there were to be a complete substitution of tungsten for can-ben lamps there would be a reduction of any 100 bon lamps, there would be a reduction of, say, 60 per cent in the output of current necessary from the electric lighting station. If a given station sold in a year one hundred million kilowatt hours to in a year one nundred million kilowatt hours to its customers when they were using carbon lamps, the demand, if there were a general substitution of the new lamps, would be cut down to, say, forty million kilowatt hours. This would mean that 60 per cent of the generating plant would be standing idle, although the fixed charges would remain. Hence, it would seem at the first blush as though a company which had been charging a fair price to its customers on an output of a hundred million kilowatt hours would have to make an increase in its rates, if it wished to make the same profit on an output of forty million kilowatt hours.

As a matter of fact, we do not look for any considerable increase in rates; it is likely that such as may occur will be only temporary in character, and this for several reasons. In the first place, it and this for several reasons. In the first place, it will be found that the principles which regulate the economic effects of labor-avenig inventions will operate with equal certainty in this matter of more efficient lighting. The labor-avening device has always resulted in a larger employment of labor, in a more efficient ways. See in the latest of labor, in a more efficient ways. efficient way. So, in the long run, the introduction of the cheaper and better lighting rendered possible by the tungsten lamp, will result in a largely in-

creased consumption.

Another condition which will serve to offset the smaller consumption of the new lamp is the fact that smaller consumption of the new tamp is the tase that the steady improvement in the standards of living shows itself markedly in the field of illumination. There is a constant demand for better lighting. From the day of the wood fire through the successive From the day of the wood are through the successive periods of the candle, the oil lamp, gas, the Wels-bach burner, and the carbon electric light, there has always been a gradual use of the superior illumina-tion, once it was provided. When people install the tungsten lamp, they almost invariably make use of more light than they were satisfied to use under the old method. So true is this that when one enters public buildings, stores, offices, or private dwellings in which the change from carbon to tungsten lamps has been made, one is invariably struck with the fact that the lighting is far more brilliant than formerly.

Another condition which tends to prevent any Another condition water to be suffered to the current sudden falling off in the total demand for current is that the introduction of the new lights is gradual. It takes time for even so brilliant an investion as the current of the It takes time for even so brilliant an investion; as this to overcome the inertia of existing ossidiators, particularly in the early days of its introduction and it is quite conscivable that the larger use of clettric lighting will in itself, particularly in sub-urban and other residential districts, serve largely to offset the decreased total demand for current. To this must be added the fact that under existing multisers which have contracted to the same conditions, the lamps cost nothing to the user, whereas the customer not only has to buy the tung-sten lamps, but he has no privilege of free renewals.

The Buneen Centenary

URS is the Golden Age of Science. But yesterday we saw the birth of wireless telegraphy; to-day we witness the dist signal victory in the conquest of the rair; and we wander what the morrow will bring forth. So condensed has been tory in the conquest of the sar; and we wender what the morrow will bring forth. So condemned has been the sequence of stirring events in contemporary history of science and the useful arts, that our sense of the wonders about us is perhaps almost in danger of being dulled by the very familiarity of these occurrences, and we may thus lose our appreciation of the spectacle of unprecedented human progress, in which it is our good fortune and privilege to be, not only witnesses, but actual participants. Indeed, the fact that we are not merely passive lookers on, but active workers, each doing his share, however modest, in the world's great work, is apt to forcelose the larger outlook from our view. We do well, in a moment of respite from our toll, to raise our cyes to the far horizon, and breathe in the spirit of our time. Inevitably we are thus led to look back into the past, to contemplate the avalanche growth of modern science, and to pay homage to the great pioneers through whose endeavors we have come into this great inheritance. is great inheritance. The current year marks the centenary of Bunsen,

The current year marks the centurary of Sumsen, of whom Ostwald speaks as "the greatest longsaile chemist of the nineteenth century, since Bersellus," Popularly, Bunsen is perhaps most widely known through two or three of his minor contributions to experimental science, to which his name has been attached. Among these are the smokeless burner, which has now invaded every laboratory and finds application for numberless other uses, and the modiapplication of the Grove cell, in which a specially-pre-pared carbon electrode is used in place of the coatly platinum. Perhaps not quite so well known is the pared carbon coexcess.

platinum. Pethaps not quite so well known is the fact that Bunsen is the originator of the bichromate cell, which may be regarded as a modification of the Bunsen element, in which chromic acid is used as depolarizer in place of the nitric acid. To physiological chemistry Bunsen has made an important contribution in the discovery of the ferric hydroxide and the contribution in the discovery of the sales the antidote for arsenic poisoning. He is also the originator of the well-known "grease spot photooriginator of the well-known "grease spot photo-meter." But these things are mere trifles as com-pared with Bunsen's greater creations, such as his pioneer work in the investigation of the chemistry of the blast furnace process, and the development of of the blast furnace process, and the development of gas-analytical methods which arose largely out of this investigation; his electrolytic researches result-ing in the isolation of the alkali elements rubsidium and cessium; his only, but brilliant research in or-ganic chemistry: the study of the caccodyl com-pounds of aresulte, in the prosecution of which he was constantly exposed to danger from poisoning and explacing and which left the research of the was constantly exposed to danger from possoning and explosion, and which left him permanently dis-abled by the loss of one eye. But by far his great-est gift to science is undoubtedly the method of spectrum analysis. This originated as an outgrowth of those "fiame-coloration tests" devised by Bunsen with the sid of the non-luminous flame of his burner, and now familiar to every beginner in chemistry. Probably Bunsen himself at the time did not dream of the far-reaching consequences which his work in spectrometry would bring in its trais. From it flowed among other results the explanation of the Fraunholf dark lines in the solar spectrum, and the

Fraunholf dark lines in the solar spectrum, and the whole field of astral clemistry was opened, giving the lie to the somewhat rash statement of August Comte: "It will never be possible to determine the chemical composition of the stars."

It is quite hopeless to attempt to give in a short compass even an approximate idea of all the fruit which spectroscopy has borne to physical science, pure and applied. Nor is this all, for there is every indication that some of the most important developments of the future, giving us that long scought-for might into nolecular mechanics, will derive fibris experimental bests from observations made by the aid of the apportsocope. experimental basis from aid of the spectroscope.

that caped of 40.5 leads a home. If this be true we in the miles minute motor has g none will attract so more ordered in priroplane English racers entered in the of these, "Ma two hydroplane Englimited power class. heen spec "Dixie II." The other, "Brunhilde," in seen in American waters this summer

by "Digile II." The other, "Bruntstine," may be seen in American waters this summer, and the summer of the summer

in the Davi is 1900 have been more than a spirit for the 1900 have been more than a spirit for the 1900 have been more than a spirit for the 1900 have been contained within the orthodox build it the British nacer. Last year the hydroplane "Breater-Despujok" cetabilished a record of 645 miles an hour over a chapt distance, with the comparatively low haves power of 450.

The original type of hydroplane as presented to the British Adsirted? by Ramine in 1872, gestewhed by Therity-root in 1877, and later adopted, hy French tagliacors, was almost a fair-bottomed boat with a single step; but she advended, when in minimum that the spirit of the built hulls, and several of the French basts have had to be withdrawn with a broken back after only three or four days' neeing. Later the French have developed a stepless type of hydroplane, the first of which gave very satisfactory results at the last Monaco gathering. The Fauber type is in a class by itself, for instead of one deep step, the "Brunblide" has five rather shallow steps and a pure displacement type of bow. Naturally, the boost has a V-section forward, the V opening out until the bost is almost flat fully astern. Frevious Fauber hydroplanes taking part in the Monaco races have proved that this type of bost has none of the disagreeable rounding which makes the original type of hydro-mounding which makes the original type of hydroplanes taking part in the Monasor races have proved that this type of boat has none of the disagreeable pounding which makes the original type of hydroplane an abomination to the crew in anything but dead calm water. Instead of the 800 horse-power motors fitted in last years "Ursula," this year's craft will only have 400 horse-power, developed by two Wolseley-Siddley motors of 6 cylinders cach. If the "Brasier-Drupajois" could develop 45 miles an hour with only 160 horse-power, it is condicatly declared in certain quarters that "Brunhilde," with more than twice this power, will exceed 60 miles an hour. This, however, remains to be seen.

The second English boat in the unlimited class is

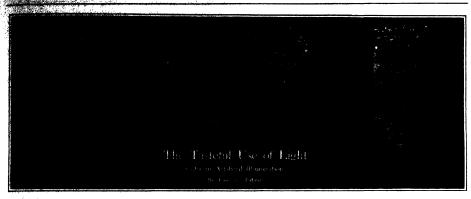
an hour. This, however, remains to be seen.
The second English boat in the unlimited class is
"Maple Leaf IV," designed by Sir John Thornycroft. This also is a hydroplane, the exact natureof which has not yet been made known. Her power
plant consists of two motors developing 400 horsepower each, or a total of 800 horse-power. One of
these motors was prepared for and fitted in last
year's "Maple Leaf," which was sent to Monaco;
but, owing to an accident at the last moment, they
were next seen in connection. The same motor but, owing to an accident at the last moment, they were never seen in competition. The same motor has been prepared for the new boat, and another one of the same type built to accompany it. Monaco will serve as a valuable training ground for the 'Maple Leaf,' enabling her owners to put her in proper trim and to obtain reliable data as to her possibilities, in the latter sace against the American champion. In a preliminary trial "Maple Leaf Iv" is stated by the press to here attained a subtrimma speed of 49.5 knots.

The Franch have not built as a continuation of the contract of the c

speed of 68,8 knote.

The French have not built an unlimited power racer to meet the English boats. Instead they have been satisfied to prepare a second-class racer having a four-cylinder motor of not more than 8.1 inches bore. The kull is of the hydroplans type. As it is impossible under the bore limitation so obtain more than 800 horre-power out of the 'Brasiler-Despilois' motor, it may seem at first sight that rictory will fall to the English craft in all the open events. But Brasiler and Despricts are not men to bow decided; even is the face of the strong force brought against them; improver, there is always present the possibility of breakdown; of these images confidence and at the efficient inscense.

R



N the consideration of the question of color in In the commonwant of the question of the eyes which are finally to receive the light are the most important factors. All the light that we can see is colored, and the nature of the color occasions a wide range of sensations, which in turn directly and indirectly have a profound effect upon the mental state. ation which does not take account of colo effects is in a lesser degree like a scheme of decoration in black and white, sufficient and satisfying only to those who are color blind. Until recently the lightneer has had at his disposed practically only light of a single color, but one has only to examine the marvelous effects now produced upon the stage by the use of colored lights to realize in some degree what could be done in general lighting if colored lights could be more generally used. The anatomists tell us that we have in our eyes three sets of sensi-tive nerves, one of which perceives light of long wave length, another an intermediate wave length light, and the third a very short wave length light; and that we are conscious of intermediate colors by two sets of nerves being acted upon at once. If light one color comes to the eye in considerable amount or for a long time, the nerves used to see that color be-come temporarily fatigued and to some extent lose their acuteness of perception for the time being, while the nerves which perceive the complementary color become more active and temporarily more acutely per-ceptive of their proper color if it should then be presented to them. On account of this inherent and universal demand of the mind for constant change and variety, we enjoy the sensation of the extra excitement of the nerves produced by looking alternately at complementary colors, and the more the color sense is trained and developed the more keenly sensitive it is to the contrasts of complementary colors, so that the trained artist sees and enjoys contrasts of color more toned with black or white than the untrained person who can perceive and enjoy only the contrasts of purer, cruder colors. The trained or educated eve has also the power to some extent to see colors whi are to the uneducated eye quite invisible; the last are to the uncutacted eye quite invision; the last colors to be perceived are those farthest away from the red and of the spectrum. Undoubtedly the educated eye can see some shades of ultra-violet light which upon the ordinary eye make no

Although the great majority of persons are not artists with trained color senses, and although some are away partially blind to colors, the wast majority have eyes with a fair degree of sensitiveness through the whole range of risible color, and consequently the laws of color must be obeyed in all artificial if

lumination or the results can never be wholly satisfactory.

It is proverbial that "colors seen by candle light do not look the same by day" and the question at once arises whether or not it would be desirable to have our illumination at night exactly the same as by day. The primitive means of lighting by burning wood, dles and then in later times by gas, all give a light which is yellowish and quite different in character from sunlight, and mankind has from time immemorisi expected that his artificial light at night ould be yellowish and different from has made everything to be seen at night of such quality and texture and color that it would be seen to the best advantage by a slightly yellowish light Whether or not it would be possible even if it were preferable to change all this by a system of lighting which would be identical with daylight, must remain for the present an open question. Our hereditary need is for an artificial light which shall be slightly Yellow is the color of brightness and mirth Through hereditary association of ideas yellow suggests to the mind the idea of brightness, brilliancy, or sunshine, while blue suggests cold, and by sug tion gives one the sensation of cold, while the contrary gives in the same way a sensation of warmth. A room lighted with reddish light gives distinctly the sensation of warmth, while a bluish illumination gives with equal distinctness the feeling of cold. Of two exactly similar rooms one of which is lighted with blue and green lights and the other with red and yellow lights every one will involuntarily select the warm light in a cool climate or the blue room in a warm climate. red is the primitive color, for a child is capable of perceiving red, the color of longest wave length, at an earlier age than other colors; and as mental de-velopment progresses, the ability is acquired to perceive colors of shorter wave length, and the continued relopment in this respect is seen in adult life in the work of most artists and persons of normal development who as their color senses become more peropinion who as their color senses become more per-fectly developed constantly grow to prefer more and more the cooler colors of shorter wave length and also to prefer colors mixed with black or white, that is, grayer or of lower tone, to crude ones, and the less glaring contrasts of low tones to the contrast of the cruder colors. This is generally true, although some with advancing age or whose optic nerves, for some other reason, become less vigorous, are able to enjoy only the cruder colors. The suggestion of the primitive color red is that of primitive desire for warmth. while blue appeals to the more developed intellectual faculty of refined thought and delicate sensation.

Blue impinges more on adjacent colors than any other color, and acts more as a modifying or toning color; when blue is placed next to other colors it ap pears to the eye to be carried more into the adjacent colors, than they are into it. It is for this reason that the finest old windows show a predominance of blue.

In lighting, as in every other appeal to the senses contrast is the important means of emphasizing and intensifying the sensation; for this reason contrasts much be very sparingly used, as strong contrasts tend to weary the senses of the beholder and a slightly varied repetition is one of the most important means by which effects can be heightened in color as well as in sound.

The lighting and shading of exterior places by awnings, etc., is not generally given enough thought wavnings, etc., is not generally given enough thought avnings are frequently placed where shade and coolness are the ends to be attained, and these are sacrifices to tone decorative effect. One of the most important principles in illumination as in decoration generally is that the primary necessity is to consider the senses affected first and the scheme of decoration or lighting must be suited to the needs of the senses, for the senses cannot be adapted to suit the scheme. The most fatal mistake in a scheme of lighting is to make it evident that the lighting is the principal thing considered; lighting that is obtrustive is offensive, wherever possible the lighting should be done by proper reflection rather than by direct rays; the effect of this reflection is the same as that of mixing wither or black with the crude colors, it lowers the

tone and makes it softer and more agreeable
One of the best illustrations of improper lighting
is in many theaters, where in the endeavor to obtain
a rich and agreeable effect dark red has been used to
such an extent that a large proportion of the light is
absorbed, making it necessary to provide lights that
are unnecessarily bright, thus defeating the very end
which the color was used to attain Lighter tones of
decoration in colors which will reflect more light and
absorb less, lowers the demands upon the lighting devices whatever they may be and diffuse in a more
agreeable way the light that is used.

Although in some respects these remarks may be open to critician, I believe the fundamental principles set forth to be essentially sound for they are in accord with the observations of a long course of work and thought on the subject. In one respect at least, and one that is frequently lost sight of, they are certainly true; the sense affected by illumination is not simply that or sight, but all the senses are directly or indirectly appealed to and they must all be considered

Combating the Sleeping Sickness

A SHORT time sluce we described int the Scrawrzzo A structure to work of the British government in conjugation with the Bigrail Sciolety's geometric with the conduction of the sleeping sickness. The work of the complete success, two camps having to be closed with complete success, two camps having to be closed with complete success, two camps having to be closed with somplete success, two camps havings to be closed with somplete, success, two camps havings to be closed with somplete, success, two camps havings to be closed with the sources of the havings of the scales of all of periods and the scales of the propagation of this closes of frush cases. The distriction which were known to be generated with this disease-carrier were carefully mapped only and by careful investigation in was bound possible to assorbists the regions of its activity. Owing this region methods always success the fifth construction, and the energy with which such were taken up it was

rendered possible to remove the inhabitants from the suspected sones and to stamp out the fly by extreme

Just recently, however, it has been discovered that the Glossian polpsile is not the only germ carrier. A death occurred in England from the sickness, and a minute pathological examination revealed the disquisting news that the parasite was of a different character from that already ascertained. Inquiries showed that the victim had come from Rhodesia, from a district 400 miles south of the limits of the haunts of the Glossies; adjustic, and further investigation resulted in the dispotent of another species of the testes by, the Glossies specificae, as being the vehicle of infection, while it was also found that several other persons in Rhodesia were suffering from the same makedy. Should such utilizately prove to be the case,

the definition of the localities favored by the mornions will be somewhat difficult as it is found over a much wides area. The region in which the case occurred has been exerched for the pulpulis but without success. It is not believed to come not far south, so that sumplicion of the mornions seems to be well founded. Possibly the former is a migratury insect and if such is the case this unsuspected attribute will be closely investigated. Thanks to the measures adopted in Uganda it is hoped that this accuracy will be completely eradicated from the country within a short time, and it is suggested that a commission should be dispatched to Rhodesin to stamp out the sourge while still in the inciplent stage, so that the country may not be so extensively affected as have been the Congo, Uganda, and other parts of the content.

Light and Shadows

Ministering to Eye Comfort by Modern Methods

By E. C. Crittenden, Assistant Physicist at the Bureau of Standards, Washington

I N the brotherhood of engineers—those benedicent genul whose touch makes nature serve us with the least possible waste of her stores of energy—the "il-luminating engineer" is a distinctly recent development. When our grandfathers sat by their tailow candles the problem of illumination was simple; for all that was required was to get enough light by which to see. Gas and electricity offer us the solution of that problem, but in their wake has come a multiplicity of new ones "Let there be light" is not sufficient; we find that there may even be such a thing as too much light, or more often, light in the wrong place. We must resultise that light in titself is not an end, but a means, a raw material. The mutual emulation of the gas and the electrical engineer has given us floods of this raw material, but what we want is not merely light, but the ability to see. That is, the light must be properly applied; hence the il-

n sources of light were feeble and the problem was simply to get enough light, those source naturally placed where they could send their bear freely in all directions, and this practice persisted more intense sources were introduce quently the first great evil which the illuminating enwas called upon to remedy was the blinding glare of lamps shining straight into people's eyes Such glare is a double evil. it is extremely wearying and therefore aggravates weakness or allments of the eyes, if it does not caus Besides that, it very materially reduces the effective illumination, so that much more light must be provided than would otherwise be necessary. The explanation for this is simple In order that objects may be seen, light must come from them, enter the and stimulate the optic nerve

But the eye exposed to the bright lamp in self-defense reduces its sensilamp in self-defense reduces its sensitiveness by drawing the iris over the uppil and also by reducing the settivity of the nerve This reduction of sensitiveness means that if an object is to be seen, more light must come from it than would be necessary if the eye were not thus trying to shut out the light. This effect can be shown by the simple experiment of placing a lighted room and trying to look pasts andle in the doorway of a dimly lighted room and trying to look pasts the candle into the room. With sources brighter than a candle the effect is more marked.

The remedy is obvious; we must have shields over our eyes or over the lamps. For indoor lighting a simple solution is found in hiding the lamps entirely, letting the light from them fall first on the walls or ceiling, where it is diffusely reflected to illuminate other objects in the room. One method of accomplishing this which is often used in public buildings is "cove" lighting; the cove is a

recess usually running entirely around the room near the ceiling in which lamps with reflectors are so placed that as much as possible of the light is projected upon the ceiling. This system is well suited for large rooms with arched ceilings, especially where the ceiling or the panels of the arches bear works of art or play an important part in the decoration of the room. A good example of the cove method of lighting is the main waiting room of the Union fistions at Washington, of which a view is given herewith. The walls of this room are of white grantes and the ceiling of ornamental plaster in white and gold. Inverted are lamps are placed in the shore of the ballocates over the veetbless, their light being reflected parity from the small arches of the balconies and parity from the great arch of the main room.

Some of the advantages of the core system will be emphasized by comparing the illustrations mentioned above with that of the south hall of the entrance pavilion of the Library of Congress where faulty illumination with hare lamps utterly ruins the effect of a splendid series of mural decorations. In this case cove lighting, or something equivalent, would be a striking improvement because the walls and ceiling are just the places where light is desired, while a comparatively low general illumination would answer all purposes for which the hall is used.

The great advantages claimed for indirect lighting are the perfect uniformity, and the avoidance of shadows as well as of glaring imps. These features make it applicable for auditoriums and public halls and for draughting rooms where shadows are troublesome. The cove system has, however, seldom proved satisfactory except in rooms where a rather low intensity is sufficient or in such special cases as those

at objects antiafactory except in rooms where a rather low inlight appeared tensity is sufficient or in such special cases as those diffused in

Dining-room lighted with four 60-watt tungsten lamps.

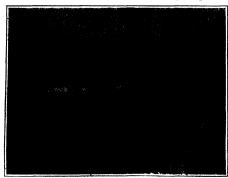
mentioned. There are several reasons for this. In the first biase its efficiency is necessarily into beauties an accessive amount of the light is thrown when it is really useless. The light must be rejected sense or possibly several times before it reaches the pipma where illumination is important. The whitege of walls will absorb at least 20 per cont of the light failing upon it, and at every resistent the wall sakes its toil. The system must be well designed in order to get hair as much light down to the warring plane as would be turnished by these such as a first property of the same lamps in three the same of the same in the effective illumination, because the system is the effective illumination, because the system of the same lamps in three for high intensity so that actually more light must be furnished in the working plane thaq would be needed there if the general illumination wavelower. Still, with our brilliant modern lamps light has become so cheap that we can well afford some loss in return for better distribution of the remaining light, and if low efficiency were its only fault cove lighting would find extensive use.

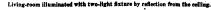
Two serious objections arise from that very uniformity which has been mentioned as being the greatvirtue of indirect lighting. It may be too uniform. The eyes, tired from the bright light on the page or the drawing before them, involuntarily seek relief by turning to some less brilliant object. Now, if on all sides they meet white walks and uniform brightness no rest is obtained and fatigue comes quickly. Another criticism arises from the absence of shadows. If we are to illuminate a painting in which the artist frees the balance of light and shade and makes the light appear to come from some definite direction, diffused illumination is destrable; but wheever form

or relief is important shadows are Perfectly diffused takes all the vigor from a statue, just takes all takes expression from the face. Can you imagine a portrait taken with uniform light from all sides? photographer's methods are instructive; he uses diffused lighting on all sides, but contrives to add to this a component of directed light which brings out the desired expression. In cases where cove lighting has been unsatisfactory a similar treatment has been found effective. The cove can be used for a general illumination of moderate intensity, while a few direct lighting sources serve to produce soft shadows and give direc-tion to the light. In an auditorium or lecture room, for example, if the light is entirely diffused, it is practically impossible to see the expr of a speaker's face, and the addition of a small amount of directed cross-

Another method of lighting without exposing the eye to the glare of

The same of the sa







A howlful of light (six 40-watt tangetons) Bluminates this room,

the might be might be the state of the state

Another modification capable of extensive application is due to the great advance which has been made in the manufacture of prism glass designed to throw the light in any desired direction. In a studio, for example, it may be desirable to have a studio, for example, it may be desirable to have a studio, while as much less intense light is needed for the extensi portion of the room. By placing jumps above a celling of prism glass one an obtain such distribution as is desired without the hideous reflectors ordinarily used for the purpose. Moreover in the case of a studio

with a skylight, the same prism glass ceiling will serve to distribute the natural as well as the artificial light

This "direct-indirect" system seems to be a decided improvement over the core system, but like it, requires special construction and is applicable only within a field limited chiefy to public or semi-public buildings. The development of successful indirect lighting by fatures applicable to the ordinary building, and therefore useful in the home, the store and the office, as well as in churches, auditoriums and

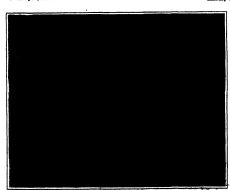


Faulty lighting in south hall of entrance pavilion,

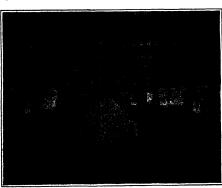
other public buildings, has been slow in coming has been hastened of late by the introduction of the highly efficient but painfully brilliant metallic filament lamps, which have so markedly emphasized the evils of glare and at the same time have cheapened the production of light so that the losses in indirect illumination are a less serious objection. By using these high-efficiency lamps in combination with re-flectors scientifically designed for high reflecting power and proper distribution of the light, and adaptable for ordinary chandeliers, excellent results are being obtained. The fixture system permits the placing of lamps so as to get the light where it is needed even with a flat celling, and the fixtures themselves, if well designed, add materially to the appearance of a room. This system therefore lends itself to the artistic lighting of a ball room as well as the effective illumination of an office or a store. In cove lighting the intention is to conceal entirely the source of light, and special pains are generally taken to avoid any unevenness which would call attention to the location of the source In fixture lighting the more successful designers have made no attempt to secure such perfect uniformity on the ceiling, and have planned the reflectors so as to concentrate most of the light in regions almost directly over the lamps This gives the advantage of getting most of the light thrown down to the working plane after only one reflection, so that a fairly high efficiency can be secured without using white side walls, and sufficient variation in intensity is secured to avoid the fatiguing effect of cove lighting. Moreover, shadows are not so entirely obliterated and objects are given a more natural appearance

For the design of indirect lighting fixtures there are no classic precedents. Some attempts have been made to gopy ancient lamps, but the treatment of the problem as an entirely new one is more almore and has produced happier results. A variety of designs are on the market, ranging from the plain round reflector to the most ornate patterns for ball rooms, hotels inchesters. Some idea of the effects obtained may be

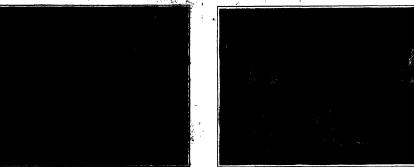
(Continued on page \$18)



Indirect lighting fixtures used in the Hamilton National Bank, Chicago.



Direct illumination in the newspaper-reading room of the Library of Congress.



Additional pringst illuminations and topium of the Angineering Societies Building.

A Part of the Control of the Control

Cove system of illumination; waiting-room of the Union Station, Washington, D. C.

Good Coal and Poor

Purchase of Coal on the Basis of Its Heating Value

By J. A. Holmes, Director of the United States Bureau of Mines

FOR many years the "unbusiness-like" farmers of this country have been purchasing their fertilizers on the basis of the perentages of the available nitrogen, or potash, or phosphate each contained, white in "business men" have long continued the purchase of coal for their fartories and residences on the basis of tis looks or its general reputation.

But during the past few years the fuel resources of the country have been investigated more carefully than ever before, and with special reference to the development of methods by which the different kinds of coal can be used with greatest efficiency, and can be purchased on a basis fair slike for the producer and consumer. As a result of this movement for greater fuel efficiency, the general government, the larger cities, and the larger manufacturing, power, and lighting companies of the country are now purchasing their coal on the basis of its heating value, as indicated by chemical analyses

COAL AND ITS COMPOSITION.

Few materials so catensively used are at the same time so little understood as is coal. The dictionaries define it; the geologists describe its origin from wast accumulations of vegetable matter, and tell us how under different conditions during past ages this vegetable matter has been transformed into different types of coal. The chemists show this coal to be composed mainly of carbon, bydones, and oxygen, with smaller quantities of ultrogen, sulphur, and other mineral substances But the meaning of this in formation in the language of two efficiency is another and more intricate proposition.

The chemist reports the results of bis examination in a form illustrated by the following analyses of four types of coal. The first column of figures (a) represents a good anthractic coal; the second (b) a high-grade bituminous coal (Pocahoutas); the third (c) a low-grade bituminous coal, and the fourth (d) a tyoleal Northwestern limits

Analyses of Types of Coal.

	(a)	(b)	(e)	(d)
	Anthracite (Furnace Coal of Good Quality)	High Grade Altumi- nous Coal (Poos- hontas).	Average Low Grade Bitumi- nous ('oa)	North Dakota Lignite.
Moisture Volatile matter Fixed carbon Ash Mulphur, B.T.U. "na received". B.T.U. "dry"	3 88 8 27 84.98 9.19 0.80 13,851.00 18,410.00	2.8 18.0 78.9 5.8 0.64 14.880 00 14,970.00	10,88 85,94 89,75 18,18 4,58 10,815,00 19,180,00	36.18 99.98 99.55 5.04 0.59 7,895.00 11,476.00

INTERPRETATION OF COAL ANALYSES.

The owner of a large manufacturing establiahment, who for the first time is presented with a bunch of such analyses, and finds his coal bill accompanied by a bill to cover the cost of these analyses, naturally inquires what it all means. The following notes may be of service to him.

The moteture; this may be partly inherent in the coal and partly external from the anow, rain, or dew, but in any case it appears to have no heat value, and the less of it he has to pay for the better.

The colsitic matter is not fully understood; It is given off as gases in the early stages of the burgith; it is known to be of real value, and furnishes the fong flame so useful under certain conditions, though a varying proportion of this velatile smaller spears to be inert, and of no heat producing value. Some of it is lost in burning, and its loss is faitmately associated with the smoke nutsance in all our cities, to escape which, as this volatile matter is greater or less, we must use one or another of the different types of mechanical stokers. The analysis of the cost adds in determining the type of stoker best skapted to its efdicent burning, but generally there must be supplemental tests in the furnace before a definite conclusion can be reached.

The furd corbon represents the chief fuel value of the coal, as the process of combustion is largely the development of heat through the oxidation of this carbon and a portion of the hydrogen and carbon in the volatile matter through their combination with the oxygen of the atmosphere introduced through the death.

The cash is a necessary but useless nuisance; and when it meits or forms a sing on the grate bars, as it is especially apt to do when high in fron, lime, and other aikalies, it becomes a troublesome nuisance by seriously interfering with the draft and efficient burning of the coal Therefore, other things squal, every one prefers a low-abl coal, and especially one with an ash that does not sing readily in the furnace. This preference is not lessened by the fact that the chemist cannot fully explain either why the ashes of certain coals sing more seriously than those of other coals, nor how this will can be satisfactorily prevented or counteracted in the furnace.

The sulphur found in coal usually occurs in the form of tron pyrites, sulphate of lime, simmina and magnesia, combined with hydrogen and carbon, or free sulphur. In best coals it is usually less than one per cent. In lower grade coals it occasionally constitutes as much as five or six per cent of the total weight. It is usually sees solved injurious to the boller tubes unless accompanied by considerable quantities of mojeture. When combined with iron (in pyrites), it is chiefly objectionable because of its tendency to fuse or form a sign of the grade bars which may seriously interfers with the draft, and, therefore, with the efficient combustion of the coals.

But the tendency of the chemist of to-day is to pass over all the above versatious and unsettled problems, and explain to the layman that the British thermal units (B.i.s.'s) represent the real fuel value of the coal—though they do not always accurately do so. A "Bit.u." is a best unit, or the quantity of heat required to relee a pound of water one degree in toniperature (from 39 dag to 40 deg. Pl.). The heat wist meed in countries other than Great Britslein and the United States is called a calorie, and represents the quantity of heat required to ratio a granies of water one degree in temperature (from zero to 3 deg. C.).

HOW THE BRITISH THERMAL UNITS ARE DETERMINED.

In the analyses given above, the anth-notice coal is described as containing 13.813 Extu's "as received," or 13.810 Extu's "as received," or 13.810 Extu's "dry coal" (dried at 105 deg, 5°). This means that each pound of this sathracite coal "as received" contained 13.835 Faitish Eternal units, or that a ten (2.000 pounds) would coatein 38.702. On B.t.u's. The number of these thermal units in any given coal may be calculated from its chemical composition; but it is unsuffly determined in an instrument called a calorimeter; and the calorimeter oney generally used in the United Sizates is the Ensistence, Atwater, or Williams modification of the Stahler, or Mallas-Brathelot bomb calorimeter. The Emerson type of this calorimeter and the meticod of using it

are illustrated in the accompanying photographs.

One gramme of flashy pulverised coal is bursed in the calorimeter in the presence of an excess of pure oxygen. The coal is lightled by the electric heating of a small platinum wire passing through the coal piaced on a tray within the calorimeter. The bomb of the calorimeter is immersed in a giren bomb of water. The increase in the temperature of this water due to the bursing of this one gramme of coal is accurately measured by a thermometer, read through a telescope by the observer, who remains a sufficient distance from the calorimeter to prevent its temperature being selected by the warmth of his body.

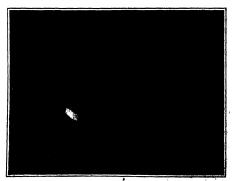
PURCHASE OF COAL ON SPECIFICATION.

Under the old method of purchasing coal it was usually preseribed that the coal should be that usually sold under a certain standard irade name, or "as good se" that standard coal, and "free from sate." But there was no means provided for the measurement of slight, or even serious, variations from this standard, except as these variations might become apparent to the eye.

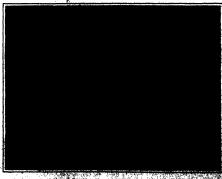
In the purchase of coal on specifications, by means of chemical analyses, even slight variations in the quality of the coal are easily detected, and corresponding variations in its value easily determined. A rational plan of procedure is as follows:

In the establishment of a new power plant for manufacturing, lighting, or heating purposes, the rances installed should be scheed with special reference to the efficient burning of the coals locally available; the engineer in charge then issues a description (including chemical analyses and B.t.u.'s) of the standard of coal he desires to purchase for his plant, and saks for bids on the basis of this standard, an-

(Continued on page 880



An observer watching the rice in the temperature of the water surrounding the "bomb" of a Mahler-Emercea calorimeter, in which "bomb" one gramme of dry, pulverised coal has been hurned.



The Mindton Manager and Mindton of the party of the party

Carrespondence

A Correction

Here of the Scurwers Armstoan: Issue of Pabruary 18th, you published an Skilled 'New Methods and New Machines for the Farm." Among the illustrations that accompanied that article was one of the Hill pulveriser, the title of which used "A Traction Ditcher for Work in Very the success was true from purverser, the title of which even "A Traction Ditcher for Work in Very Wet, Sticking Ground." This machine is not intended for that purpose, but is a new self-propelled device intended to prepare altivist self for the planter. It purverses from five to fifteen acres of such soil per day, cutting 18 feet wide.

THE BUCKETE TRACTION DITCHER COMPANY. Findley, Chic.

The Emu

To the Editor of the Scientific American: in your issue of January 7th, 1911, I noticed a para

graph in an article, "Great Zoological Park," in which you state that the emu is now almost extinct. This statement is very misleading, as they still exist in very large numbers in north and northwest New South Wales, and practically all over Queensland, south and western Australia. I saw many hundreds south and western Austrains. I saw many nunurums myself last year while on a shooting trip in western Queensland. I am certain it will be very many years before they are extinct, as they are practically values.

G. H. Rowetts.

Boggabri, New South Wales, Australia.

Daylight Observations of Venus

To the Editor of the SCIENTIFIC AMERICAN:

In my article on "Locating the Pole by Daylight Observations of Venus," the first mentence of the last paragraph reverses the intended meaning of the sen

It reads, "When Peary was at the pole April 6th, 1909, Venus was favorably placed and could be seen." It should read, "When Peary was at the pole April 6th, 1999, Venus was unfororably placed and could

Indianapolia. Ind.

A Letter from the Home of the Secretary Bird

To the Editor of the SCHETTITIC AMERICAN:

I have read your interesting article on secretary birds, with the splendid photographs of them killing snakes. I have often seen them when I was living in the eastern portion of Cape Colony. There was usus a pair on the estate, and we would see them in the mornings performing their rounds over the veid looking for food. They are very graceful and handsome birds, and show up well in the distance on their long

legs. I should not say that they equaled a horse in running. More like ten miles an hour their speed seemed to me. If you walked after them, they would increase their pace from a walk to a run, and finally take to their wings. If the wind was blowing from behind them, they had to face round first and take a short run against the wind before they could leave the ground. A useful hint for the Messrs. Wright for their aeroplanes, which I daresay they have already made use of. High up in the air it needs a trained eye to distinguish them from a vulture. It resembles somewhat the South American carlama, and is per-haps allied to it. The nests that I have seen have been on low trees like the Australian wattle or mia, at about ten or twelve feet from the ground, and it is interesting to notice the weaver birds with their curious and ingenious bottle-shaped nests, hung to keep out snakes, choose the same tree to build in, divining no doubt that they will be safer there from their enemies. The nests that I have seen are not so large as your article mentions. They are about three feet. I should say, in diameter, one and one-half feet made chiefly of sticks, and without turf sods I think it was a curious sight to me when I climbed up, looked in, and saw the tremendous youngster fill ing up the whole space-its large eves, as hig as mine. with great eyelashes, unlike most birds had been two, but one may have been carried off by hawks. I have sometimes approached the nest when another bird has been sitting, or perhaps the male bird; and though I have stood just beneath and thrown up sticks to make it move, it has for long refused to stir, till at length its paternal affections being overcome, it has got on the edge of the nest, and given itself a push off into the air, leaving the contents to their fate. Its appetite is not exactly what one might call delicate, as the following bill of fare found inside a femsle will show: One tortoise, eight chameleons, twelve lizards of two species, three frogs, one adder, two locusts, two qualls, besides other remains. popularly supposed to be strictly preserved by the law of the land, but this, however, is not the case, and many would like to see their extinction, as they kill numbers of the young partridges and hares. They are sometimes kept in captivity, but are difficult to rear, owing to the brittle nature of their long legs. I hope that these few notes will interest your reader T. B. BLATHWAYT (B.A. Oxford).

Cape Town, South Africa.

Some Points in Philosophy of Science

To the Editor of the SCIENTIFIC AMERICAN:

ver since I can remember, I have favored science and scientific methods as opposed to metaphysical culation, but for that very reason I have been to dip rather extensively into metaphysics, and have reached the conclusion that most of its errors have been caused by basing trains of reasoning upon unde-

fined or ill-defined notions.

In your issue of March 18th, you give extracts from

an article mentioning four fundamental assumptions underlying science. First, that absolute truth exists; cond, that we are part of it, though "we make all the errors, nature none;" third, that things have a real objective existence; fourth, that things are different from our sensual perception of them.

Now absolute truth means neither more nor less

than complete knowledge; anything that is, is true It is only when we contemplate it in relation to other things, that error creeps in Absolute truth demands full knowledge of all the relations of the thing under consideration, and this involves the relations b all other things.

The second assumption is correct. We are a part of the world in which we live, and error is simply lack of comprehension

The meaning of the third assumption depends on the meaning of "objective" We have no possible the meaning of "objective" We have no possible means of knowing that anything exists, apart from our perception of it, and so the only possible test for objectivity lies in sensual perception Since we certainly do perceive things by the senses, these things certainly do have objective existence.

The fourth assumption is an error. The objective thing is exactly what the senses report-for that is all there is objective about it; but the senses are unable relations. The relations between things are ascertained mentally, and are subjective. Science is really engaged in discovering subjective, not objective laws-conditions of consciousness and experimeans by which we may foreknow, and to a great extent control, not only subjective phenomena. but also our actual sensual perceptions, or the ob-

The subjective character of mathematics is generally recognized, but the equally subjective nature of scienhypotheses is almost as generally overlooked The truth of a theory, like that of a mathematical proposition, depends solely upon its self-consistent consistency in all its necessary relations, subjective and objective The value of a theory is to a considerable extent independent of its abstract truth, depending merely upon usefulness There has probably never been a more valuable theory than the mechanical theory of matter—heat, chemistry, etc—although this theory is constructed in terms of the most crude, primary, and obvious generalized notions, formed from sensual experience

In fact, the value of the mechanical theory has lain largely in this very obviousness, which enables it to be grasped by inferior and by undeveloped minds. In its endeavor to embrace all phenomena, this theory is now becoming so complicated that for most purposes its ideas of substance and motion might well be replaced by those of force and direction; nor is it probable that all phenomena can ever be expounde in these terms—not to mention that great unknow-able in which all ultimate causes are hidden, and must remain hidden, until the conditions governing consciousness are radically altered.

Asheville, N. C. ALLEN G. MILLER.

Drawing the Charge-Our Cover Design

THE cover design of this issue is a reproduction from a painting by J. C. Chase, depicting an incl dent in the manufacture of coal gas for lighting and cent in the manufacture of coal gas for lighting and beating. It shows the emptying of the retorts at the works of the Consolidated Gas Company, at West Forty-second Street, New York, a procedure which is technically known as "drawing the sharge." Bash retort receive a charge of shout 500 pounds of bijuminous "long Ensus" coal. The heat of the fur-

Bash retort receives a charge of about 200 pounds of bitumbour fong faune" coal. The heat of the furnance states the retort resches a maximum of 2,500 degrees. The precess requires about four hours for each sharps, and the heat in the retorts ranges from about 900 degrees. The precess requires at the sharps and man 2,000 degrees are the sharps of the four hours.

In the precess of destillation, the coal fact cinters down assessment, after which, as the heating in our interesting the precess of destillation, the coal fact cintered to the precess of destillation, the heating in our continued a first seal, so that it signatures a parcess structure and is interesting to our preceding the large and the retorn the seal of seal of the precess of a parcel structure. The mass of seal of the precess of he manned that the seal of seal of the precess of he manned of the precess of the seal of the seal of the seal of the seal of the preceding the four of the seal of the preceding the four of the seal of the preceding the four four particular and the seal of the preceding of the four four particular of the preceding the seal of the preceding of the four four particular of the preceding the seal of the preceding the four four particular of the preceding of the fifther than four particular of the preceding of the fifther than a first of the preceding of the fifther than a first of the first of the preceding of the fifther than a first of the first of the preceding of the fifther than a first of the first of the preceding of the fifther than a first of the first of the preceding of the fifther than a first of the first

matter, coming in contact with the air, bursts into flame and casts a lurid orange glare over the sur-roundings. Men in gangs of three or four now draw out the coke from the retorts by means of long rakes. This coke falls through open traps to a floor below, where it is cooled by streams of water. The red-hot where it is cooled by streams of water. where it is cooled by streams of water. The red-hot coke on coming in contact with the water raises thick white clouds of steam enveloping the workmen so as to sometimes atmost completely hide them from sight. The drawing of the charge completes the process, and the retorts are now ready to receive a new filling, after which the same operations are re-peated as on the previous charge.

The Adoption of Greenwich Standard Time in France

On February 10th, 1911, the French Senate pass On storemen luta, 1911, the French ments passed of a bill which makes Greenwich time legal in France. When the legal in France. When the legal in France. When the legal in France will become aims minutes and twenty-one seconds slower than it is now. In order to avoid the expense of alteriag charts and salling instructions, the ponise of sidering charts and sailing instructions, the law will not supply to French naval or other vessels, and it is not likely that any change will be made in the Commissioner des temps and other French al-manacs. French reliways are now run by a stand-ard fire ministric slower than Paris time, and the clocks inside sightlens are regulated by this standard, while the cleekle as the outside of the standard, while the cleekle as the outside of the statutes give the correct Paris time. This confusing system will be abeliabed, and both the attender and the interior clocks will be regulated by Greenwich time, by which the trains will be are. the trains will be run.

The French and British governments once came to sort of informal agreement or understanding that France would adopt the meridian of Greenwich as a base of longitude and time, on condition that the metric system of weights and measures should be made compulsory in Great Britain of the agreement has not been carried out, and it is a curious circumstances that, while the French Senate was debating the adoption of Greenwich time, a demand for a standard of time varying with th of the year was being made in Great Britain. The system of standard time sections, furthermore, is not used in Ireland or in India, and its abandonment was recently mooted in Germany.

In France, henceforth, Greenwich time, reckoned

from midnight, will be the legal time for civil trans-actions, while Paris time, reckoned from noon, will be retained in the navy, merchant marine and astro-nomical observatories. France will thus be included in the Western European standard time section, with Great Britain, Belgium, Holland, Spain, Portugal and Aigeria

Central European section, the time of which is one hour later than that of Greenwich, com-prises Germany, Switzerland, Austria-Hungary, Italy, Norway, Sweden, and Denmark The Eastern Euro-pean section includes Bulgaria, Roumania, Turkey, Egypt, and East Africa, in all of which countries the standard time is two hours later than that of Greenwich. North America is divided into five sections: Intercolonial, Eastern, Central, Mountain and Pacific, having their standard time respectively four, five, six, seven, and eight hours earlier than that of

Heating the Home

Methods of Providing Warmth with Proper Ventilation

By James F. Martine

R ESPONDING to the demand of the comfort-loving American, heating engineers of the United States have perfected systems for keeping the home warm that have become standard all over the world.

With assurance that the very best heating sys-

tems to be had are right at hand, it only remains to make intelligent application of the system best make intelligent application of the system obes-suited to the particular heating requirement Upon the correct application and proper installation of an adequate heating system depend the comfort and, to a large degree, the health of the family, for some six to eight months of the year

Yet, strange as it seems, but little personal atten-tion is given to the details of the important matter of heating Occasionally a preference is exercised for some particular system or method, but without due consideration of the adaptability of that sys-tem or method to heat the home properly and economically It is more easy and customary to leave it entirely to some local heating contractor. There are exceptions, of course, but particularly in the case of new homes, most of the time, thought, and money are expended on design and ornamentation of the in

The preferences for some heating systems, and aver sions to others, are based on popular fallacies that it is well to explode. Some prefer hot water heating, believing that because of the water it must give a moist heat. As a matter of fact, hot water heat in no way supplies moisture to the air. This will be appreciated by references to Fig. 1 in the accompanying drawing. The function of the water circulated is only to convey the heat to the various radiators, and as all joints, etc., must be watertight, it is not possible for the air to receive moisture from this source. The makers claim for hot water heating systems a more uniform heat, but not that it supplies moisture to the air.

Many are prejudiced against warm air furnace systems, and why? They say the incoming air brings dust and in passing around heating drums must draw gas and dirt through the radiator pipes into the rooms; also that contact of the air with iron of the heating drums consumes oxygen. As a matter of fact the heating drums do not become heated to a temperature necessary to consume oxygen. Fig. 8 showing the route the air takes to reach the rooms. It is impossible for gas to be drawn from this type of furnace into the rooms unless some part of the heating drum or furnace proper should crack or a joint spring open. Assuming that a certain amount of gas did reach the rooms, it would be more easily detected than a wide open gas jet. The chimney draft exhausting the gases from the furnace are always s stronger than the slight air current p ing around the heating drums and thence to the rooms. Therefore it is most unlikely that gas would reach the rooms from slight openings, and should it do so from large openings, prompt detection would

Because of the stuffiness in overheated. ventilated rooms, it is thought by some that steam heat uses up the oxygen in the air. Though steam heat is quite indispensable, some remedy would be welcomed. The cause is lack of proper ventilation, and is in no way due to the heating system. We know the composition of air in its natural state consists of oxygen twenty volumes, nitrogen seventynine volumes, and carbonic acid gas one volume, also a slight trace of watery vapor.

The state of air after it has once been breathed has parted with about one-sixth of its oxygen and taken up an equivalent of carbonic ac beathed successively a few times would part with all its oxygen and sould no longer sustain life. The impure air containing extends and gas, expelled frees the lungs, is rarified by warmith and temporarily the image, is rariled by warmta and temporacity riese, but upon cooling it descends said lies in gress-est density near the floor. Contact with the bot redd-ators causes this carbonic gas index air to the sait is again rarified by the heat. The lack of adequate votilation causes the same poisoned air to be breathed over and over, producing the drowniness and stuffy feeling complained of.

reathing is a form of cor coal, wood, candies, gas, oil, etc., similar action takes place. Steam, hot water, warm air, and electric heating systems do not in any way affect the air with the exception of making it more dry, rarefied, or ex-pended. The radiators are distributors of heat, but do not use oxygen or in any way change the elements of the zir, as the heat is generated in the furnace and a proper air supply is provided.

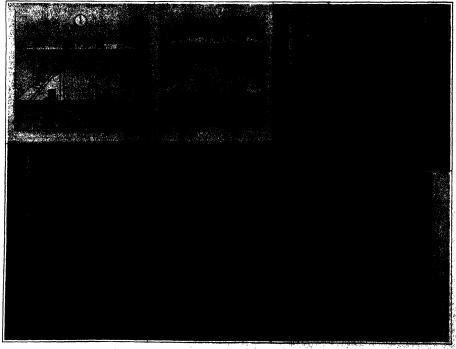
Then the vital importance of proper ventilation is

manifest, and it may be most readily and economically provided for in connection with any of the modern heating systems. If a new house is planned, ventilation should be arranged for, together with the ventilation should be arranged for, together with the heating system. Old houses heated either by stoves, direct risam or warm air should be provided with some adjustable ventilation, particularly if fitted with storm windows, or if the windows and doors are well weather stripped and fit tight. Some win-dows can easily be fitted with a ventilator and good results be secured.

In selecting a heating system, a little time given to consideration of general conditions will avoid ex-

(Continued on page 889.)

SAL WEST WALLES



1. Direct hot water heating system. A Single pipe steam heating. S. Details of a warm air system. 4. Plan view showing best position for a water six Direct hot water. 4. An indirect heating installation.

Lamps of To-day

Some Recent Improvements in Artificial Light Sources

By Joseph B. Baker

A CORE light" is the word of this twentieth cen-lifetury of tetrapsified life, the universal demand in home, office and featury, and this demand is being mist by the laventive talent and manufacturing enterrise of to-day. The active emulation now existing so the various light sources, beginning with the invention of the incandescent electric lamp and its le competitor, the incapdescent was mantle. resulted to date in a number of different ing systems utilizing electricity and gas, and it is the purpose of this article to discuss some of the more recent lamps which have been put into actual com-

Efforts to produce a light of true color value by means of the electric arc have resulted in the "in-tensified arc lamp," which is a modified form of the well-known inclosed arc, based on the demonstrated principle that the light-giving efficiency of an elec-tric arc is inversely proportional (within the conare is inversely proportional (within limits) to the diameter of the carbons; for example, 500 watts the disaster of the carbons; for example, but water put, into a quarter-inch carbon gives almost double as much light as with a half-inch carbon. In the intensified arc lamp there are two positive carbons of very small dismeter (aix millimeters, as comwith the ordinary single fifteen millimeter positive carbon) and one negative carbon, also of small diameter. The current density at the carbon tips is extraordinarily high, resulting in a far higher degree of incandescence than in the ordinary lamp, so that the white light emitted from the carbon tips is a much greater percentage of the total light emission. For color matching the light of this lamp equals the best results attained by other means.

In flaming and luminous are lamps the light is emitted from the arc itself, there being very little radiation from the electrodes, and the luminous efficiency is three to five times that of the best pure carbon arcs. As far back as June, 1906, there were at least ten different makes of faming arc lamps in Europe. Among these were the Bremer, the Stamens. and the Koerting and Mathiesen; but at the present and the Koerting and Mathiesen; but at the present time their name is legion. The recent improvements are very largely based on the work of Bremer, in 1888. A distinction must be drawn between the fiame are lamp, in which the electrodes are of cored carbon, the core being impregnated with light-enriching metalile saits, and the so-called luminous are lamp, in which the electrodes are entirely metallic, with no carbon. Typical examples of this kind are th magnetite lamp of the General Electric Company and he Westinghouse metallic fiame lamp.
Flame lamps with calibrations impregnated with cal-

cium and sodium carbonate give a yellow or yel-lowish-golden light, and impregnation with strontium and rubidium saits gives a reddish pink light. The color of most fiame lamps in common use to-day is yellowish, as it has been found that the yellow light-giving saits are by far the most efficient. Flame lamps giving a white light are also used to some ex-tent, but the barium saits employed have a lightgiving efficiency equal to only about half that of the yellow light-giving salts

In flame lamps the recent developments have been in two directions: Longer life and higher luminous In one new lamp a small inclosing globe conserves the life of the carbons and at the same time secures a better distribution of the illumination The products of combustion are for the most part carupward and condensed on the upper surface the inclosing globe where they cannot interfere with the light. In another form, the hot gases are continuously circulated through the inclosing globe by an induced draft set up in a pair of curve connecting the top and bottom of the globe; the gases, with volatilized metallic salts, pass out at the top only to re-enter at the bottom and so give a In this lamp not only luminous efficiency increased, but the life of the carbons is conserved to a remarkable degree-a pair of carbons lasting seventy-five hours or more, or five times as long as in the absence of the regenerative feature.

The magnetite lamp gives a high efficiency, and has the added advantage that the magnetite electrode consumes at an extremely slow rate, a stick five inches long lasting 175 hours (corresponding to at least two eks for an all-night street lamp).

Very important improvements have recently been made in two well-known vacuum-tube lights, the Cooper-Hewitt and the MacFarlan Moore, making available on a commercial basis the advantages al-ready possessed by these systems—long life and high us efficiency—and giving a decided impulse to their wide practical application.

The light-transforming reflector for use with the Cooper-Hewitt lamp, which has already been described at length in these columns (see page 502 of SCIENTIFIC AMERICAN for December 24th, 1910) is an absolutely unique solution of the problem of obtain-ing illumination of satisfactory quality or co'or value from a light source having an ill-balanced spe trum. Briefly, this invention consists in utilizing the little understood phenomenon of fluorescence to transform the radiation of a given light source from one set or range of wave lengths into another entirely different set. As applied to the well-known mercuryvapor tube, a concave, trough-like reflecting surface, coated with a translucent film impregnated with rhodamine dye, receives the light of the tube and gives it back in altered form, the greenish light becoming converted into rays of wave lengths lying in the red and orange region of the spectrum, so that the

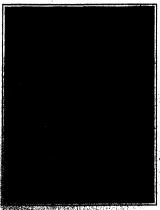
lamp equipped with such a reflector gives an illumination similar to "daylight" Although the light-transforming reflector has not yet been developed for general commercial use, it is to be expected that it will render widely available not only the mercury vapor tube, but other light sources, which although highly economical are at present unsuitable for gen-

eral illumination purposes

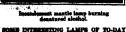
The MacFarlan Moore white-light window is the culmination of twenty years of patient labor by its inventor, in pursuit of an ideal In 1891 Mr Moore, impressed by the unsatisfactory color of existing incandescent lamps and with the absurdly low efficiency of transformation of heat energy into light by all methods, was fired with the ambition to produce by electrical means a light source which would reproduce electrical means a light source which would reproduce daylight. At the outset he was convinced that luminous radiations could be produced by a less wasteful method than as a mere by-product of heat, and that no department of physical science offered more inspiring opportunities than that of generating "light without heat" Moreover the utilization of a gas as the working medium held out the promise of being able to take advantage of the selective vibration ses. He therefore turned away entirely from the notion of a heated filament of solid resistance manotion or a neared mamment of some resistance ma-terial for the conversion of electrical energy into light, and began investigations, using a column of rarefied gas. The result has been the Moore tube rarefied gas. The result has been the Moore tube light, of which the light window is the most recent

The light window is virtually a portable box of artificial daylight, giving in effect a generous north window open to the unclouded sky of summer, available at any time by simply turning on a switch, and giving a true and unchanging illumination throughentire twenty-four hours of the day if desired. It consists of a metal case containing a length sired. It consists of a inetal case containing a lengitude of the Moore light tube (a 1½-inch clear glass vacuum tube, filled with highly rarefied carbon di oxide gas and traversed by an alternating current) and giving a pure white light of about 200 candle-power, but of remarkably soft illuminating ef-ficiency. The ordinary outfit is equipped with a tube adapted to 220-volt, 60-cycle alternating current A simple "breathing" device, operating about once every minute with remarkable regularity as long as the cir-cuit to the tube is closed, keeps the contained gas in the right condition for most efficient generation of light.

The light window is singularly well adented to fill a great existing need One notable application is in the department store, where at present the purchaser of a piece of goods will often ask the sales carry it to the entrance of the store in order that (Continued on page 491.)









Color work under a mercury-vapor lamp with

Light and Power on the Farm

Independent Electric Generating Plants

By Putnam A. Bates

The prevailing impression of a farmer's life is one things is not a cheeriv' one, but too often it is well stroughed. The pleasure of active life in the countries greatly leasened by the inconvenience of things and under such handleap the accomplishments of the farmer do not compare favorably with those of menengaged in other pursuits. This state of affairs, of course, is not universal and can be rectified by the introduction of efficient methods of arriving at results. Thorsting, however, is an easy task and improvements based on radical reforms seldom reach the desired goal

Before prescribing methods of improvements for the farmer, one should piace himself in the yoke for a while, in order to know what the conditions really are A short experience will prompt greater respect for the subject of our condideration, for farming is a many-aided problem, and one must be blessed with unusual poles to succeed in such a field

It is also essential that whatever recommendations one would venture for the farmer's improvement should be of such character as to permit of practical application to certain definite conditions. Otherwise, the ideas, good in themselves, will mislead or be rejected as impractical.

A brief study of what farming really is, and how it compares, from a business point of view, with other industries is all important, for there are innumerable branches in which one may specialise farming, as in other industries, and we find a wide range in the quantity and quality of the products turned out by various farms, even in an agricultural section of limited range. How important, therefore, it is that we define the kind of

farming problem we are trying to improve before we state the means by

which the results are to be obtained. A man will umbark in manufacturing because he sees an opportunity to surceed in life by doing so. If will prepare himself for a professional career, and after due qualification he will apply himself to his line as a life's work. Yet of agriculture we are continuibe hearing the question raised, "Is it phesible to make a farm pay?" We may as well sak, will a factory pay, or can a lawyer make a living at his profession? I have been told that the remuneration of the average lawyer is just about that of the average lawyer is just about that of the average school teacher, which fact is, I think, a fair answer to the latter question, and illustrates that it rests with the individual to succeed or fail.

Naturally, a farmer cannot run a large farming proposition on a narrow gage basis and make much of it, nor is it feasible to equip a small farm with all the possible conveniences and labor saving devices, if the total possible

product will represent only an income return on a small investment.

There is, therefore, no sound reason for regarding farming business as different from any other, in so far as not results are concerned, the object of all business being to provide a living and enough more to be on the safe side in case of possible reverses. If one cannot see such an opportunity in farming, efforts should be directed elsewhere.

There is a peculiarly remantic side to country life that seems to lead persons wholly unqualified for any business to believe they will succeed at farming. This, of course, is unfortunate and accounts for many failures, but the reason for it is easily explained. In manufacturing, an industry is appaised on the

In manufacturing, an industry is appreciated on the basis of the intrinsic value of the facetry and general plant equipment, its unitability for turning out the product in greater or lesser quantities than competitors, and at greater or lesser coat. If property and buildings are appropriate, but capital is insufficient to properly equip, then capital is obtained by bonded debt or other approved method, and the funds are applied for this purpose and machinery is selected, with a view to obtaining the greatest returns for a given sum of money invested.

Successful farming must be developed on a similar basis, for the agriculturist is a producer, and his problem is little different from that of the manufacturer. His materials and operations are different, but that is all.

How often do we see farmers struggling through life with vasity more land than they can successfully manage with their degree of business ability, with a mortgage obtained to send the sons and daughters to Try years ago, and practically as above integrity picks as in the property of the property of

school or college, the buildings entirely as in both design and location for schemble of a mechanical equipment that executed and

nowever, is based on its capability to predice, or, its personnel, and its capability to make it produce. In a manufacturing business, it is expected that capital will be turned over one or more times a year producing gross profits of 5 to 10 per cent on each turn over, and in farming, we should expect the same. A 500-acre farm, valued at \$100 nm serve resonants 800,000 capital. To turn this over once means that such acre must produce a total crisp law-ring a market value of \$100. This result is possible, and where farming is successful, such return is not numeral.

These ideas seem like simple truths, but they are conditions that must be recognized. How much better is it for the farm mortpage to be applied in improving the operating conditions, build-

proving the operating constructs, southings and equipment which will at ease oreate a new interest for the absences of the younger generation, and lessen the labors of the farmer himself, and but the proposition on a basis similar to that found in manufacturing, the Sooth spinning milts, for example, where the business passes from father to son, each one making his success in turn. This, however, cannot be done without the constant intreduction of those improvements which are demanded by competition.

The crecion of more suitable buildings, better located and planned for greater convenience, is a sustain need on the farm. Provision for assitation, with respect to the water supply and savage systems is also a matter of im-

It is safe to conclude, however, that success in farming especially requires good management, and due to its manifold applications, electricity is proving to be the force in nature most capable of assisting in the accomplishment of

(Continued on page 207.)

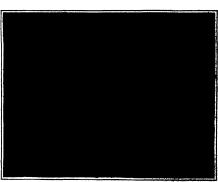


Fig. 1.—A high-powered equipment for a large form

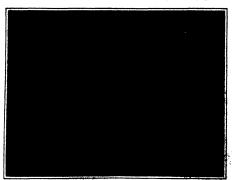
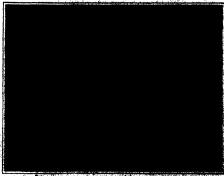
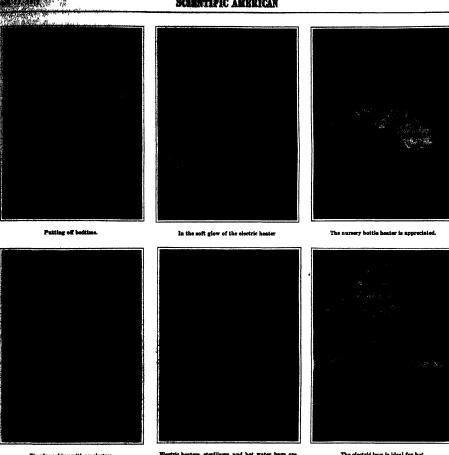


Fig. 2.—Small plant with storage battery auxiliary.



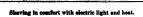


Simple cooking with an electric chaing dish.

Electric heaters, starilizers, and hot water bags are invaluable in the sick room.

The electric iron is ideal for hot weather





Inventing the Light of the Future

The Eye as the Ultimate Judge

CONSIDER the devious method of producing light in the bulb of an incandescent lamp. Cost must be showled into a furnace to heat a boiler. Steam must be generated and fed to a steam engine. The steam engine drives a dynamo. The current generated by the dynamo is conducted to its destination by wires and at last reaches the filament in the little glass bulb.

In producing the most efficient srtificial light known only about five per cent of the energy in the coal pile is used in the form of visible radiation. The remaining ninety-five per cent is wasted chiefly by the steam engine and in producing heat rays that are not visible.

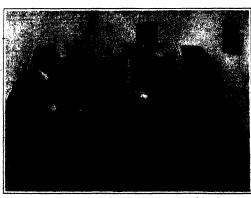
Compiler now, the fire-fly, a creature which you can hold in your hand and feel no heat and which glows intermittently at will. Bludles made many years ago by Dr. Samuel P. Langley and repeated more recently and more chalorately by Dr. Ives and Cobbetts, show that the fire-fly's efficiency is about 98.5 per central tis light is well-nigh cold. What more striking illustration of the wastefulness of man and the seconomy of nature can be desired?

It is partly because the eye must be considered first and last that the problem of inventing a really efficient light is so very difficult. Then, too, there is the difficulty that light is not a physical quantity like gravitation or electricity, but rather the effect upon the richins of certain kinds of radiations. Of all the radiations which are constituously bomharding the human body, only a few affect the eys. It so happens that the sum and all artificial lights are designing us not only with radiations that we can see, but with a great many more that we cannot see. For example, there are those radiations which manifest themselves as heat, and again those which we know only by the way in which they affect photographic plates and chemicals sensitive to light. In the visible range of radiations, moreover, the amount of energy varies considerably. Thus, the visible radiations that we call green light represent an entirely different amount of energy and a much greater physiclogical effect than the same amount of energy in rays that we call light. The problem is still ruther complicated by the fact that not only is the amount of radiation for any color different from that of any other color, but that the intensity, and consequently the effect upon the ever varies with every color. A green light and a red light at a certain distance appear of equal brilliancy to the eye, but reveal different intensities at greater

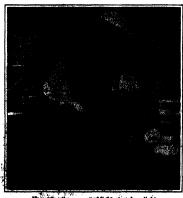
distribute. Then, again, the medical by which a ray of light to able to etiminate the enting of the optioners in the retine so that we can see it not yet materiolog.

The problem of preducing an artificial light to compare favorably with that of the fire-fly involves research of a kind that can be undertable only by a splendfully acutaged laboratory supported by an almost princely endowment. A single physicist or cleants to engineer may possibly make important contributions to the solution of the problem; but the skilejage light of the future, in all likelihood, will be theywise not of a single man, but of many men, of generations of men, parkage, who have conducted paintending researches in the physics, chemistry, and physiology of light. The problems become ac complex, no special in their nature, that only specialists can hope to deal with them.

To tiggree the shorte light, in quality, to find out thow different lights affect the sre, to profuge light with less waste of gown, twenty manufacturing companies have cetabilished at Clevshaud, Ohk, a remarkable group of aboratories, which, in point of equipment and in the nature of the studies there carried out, rank with the research and engineering labora-



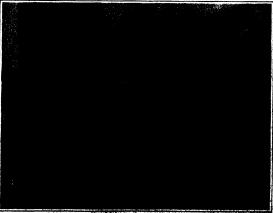
An apparatus for studying the infra-red radiation of various artificial illuminants.



Measuring the amount of light given by a light and its reflector at all angles.



Phospheroscope for studying the light effect of phospheroscopi materials.



A Zoins color-mixing approximation for blooding together radictions of regions state.

of the government and of richly-endowed in-

The state of the subjects to be studied that not said have these companies established laboratories for the surely commercial development of the electric lastif, but kine a special physical laboratory at the head of which stands Dr. Edward P. Hyde, formerly of the Judied States Bureau of Standards, in which laboratory a wast amount of pure scientific research, quite devoted of any direct commercial use, is conducted, and which has for its specific purpose the proper co-ordination of physics and physiologs.

How very essential is purely scientific research in the improvement of artificial illuminants is apparent when we consider the peculiar nature of light.

when, we consider the peculiar nature of light.

What we call light does not exist in the universe agard from year that see it. The light rays that physical science deals with are in themselves no more red or blue than the dark heat rays or than the X-rays. The sunshine has no splendor except to our retinas. By this we do not mean that the sun does not exist, but simply that the blue of the sky, the green of warging trees and waving grees, are due simply to the magical property of a piece of living tissue, a tissue onlied the retina, and endowed with the mitrations power of transforming rays and undulations of a certain degree of rapidity into mental pictures of unusueakable beauty.

A German professor is reported to have said that.

If a student of his were to submit to him an optical instrument so peorly constructed and so inefficient as the sys, he would probably "pluck him," on examination. But the sys is a good deal more than a Iras, an aqueous humor, and a retina. It is a camera, a dark room, indeed a whole chemical shoratory; for here the most wonderful chemical ploratory; for here the most wonderful chemistry in the world indone. The syr takes the pleture of natura, develops it, and presents it to your vision, all in one operation—far more than has ever been done with an instrument of human invention. Because we must instrument of human invention. Because we must instrument of human invention. Because this romarkable complicated camera and inbovatory was planned by nature to despit itself to the requirements of sunlight only, because instrue, perhaps, never contemplated the use of artificial illuminate by man, it is not easy to invent a light which will not only be cheap, but which will not only be cheap.

Hence, to invent a highly efficient light, not only the engineer and physicist, but the physiologist and even the psychologist must each do his share

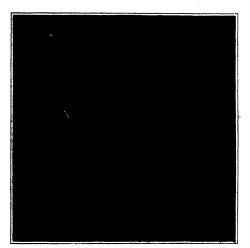
Suppose, for example, that the engineer had really succeeded in producing a light in direct imitation of the fire-fiv. He would find, as Dr. Herbert Ives, a member of Dr Hyde's staff, has conclusively shown by spectro-photography, that his artificial fire-fiv, although very efficient in the consumption of energy.

would be quite unsuited for general use. It is too green. If you have ever stood beneath a mercury are and noticed the purylish veins that crawl over a glassity green flesh, you can picture the effect of a thousand-candle frie-fly. Green is the most efficient light because the yellow-green portion of the spectrum is most intense Curiously enough, the greenish mercury are is one of the most efficient lights that man has produced. Hence, science and engineering have approved the fire-fly's choice of color in getting efficiency

The physiologist would object to any slavish imitation of the firefly on the score that a yellow-green light, however efficient, would be injurious, and would distort color values. The physiologist would protest against the use of a greenish-yellow light of 98 per cent efficiency, and insign upon the employment of a certain amount of red rays. The most employment white light of the future would be cut down by the physiologist to approximately 40 per cent of a yellow-light remaining the filtering the firefliciency.

So far as we can now foresee, high efficiency in the light of the future can be obtained by one of three possible ways or by a combination of these. One of them is to confine the radiation to the visible spectrum, as the fire-fly does, overcoming the objection cited by properly blending it with other colored radiations produced with equal efficiency

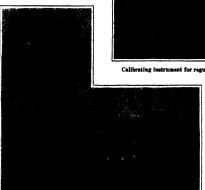
(Continued on page 395.)



An instrument devised to analyze the effect of side illumination on the eye.



Country for automotically registering the



Making microphotographs of filament cross-sections in order to study



Calibrating instrument for regulating current supplied to life racks.



A corner in the lamp-testing laboratory.

APPARATUS FOR STUDYING THE ELECTRIC LIGHT

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

Artificial Rain

RRIGATION was practised extensively in ancient times in Egypt, Assyria, Persia, China, Japan and dia. It was employed by the Moors in Spain and by the Romans in Italy, and the Spanish conquerors found great irrigation systems in existence in South America In many of the lands especially in China primitive and traditional method of irrigation is still in use, while in California, Texas, Northern Italy, Southern France and elsewhere, deserts have been converted into farms by systems of irrigation constructed on the principles of modern applied science

An irrigation system consists essentially of a net work of canals and ditches which traverse the arid region and are supplied by pumps or by dams and reservoire The water either seeps through the walls of the ditches or is caused to overflow the land by damming the ditches. Irrigating systems are con-structed for large districts and also for single farms

and fields In the latter case pipes are often sub stituted for ditches, and the pipes are sometimes connected with sprinkling apparatus by which the water is distributed over the land in the form of artificial rain. These devices are not very largely employed, owing to their great cost of construction and operation, their rapid deterioration under rough usage, and other defects

A new apparatus, devised by Hartman, which has given good results in any, is described in a recent issue of Prometheus. from which the following account is taken

The water is drawn from any convenient pond, stream or spring, and is pumped to the field through a portable system of pipes laid on the surface of the ground (Fig. 1). The power may be obtained from the traction engine (Fig 2) with which every large farm should be provided The sections of the water main (Fig 1) are connected by very simple and quickly operated clamps, without screws, and the main is provided, at intervals of 66 feet, or 4 rods, with 66 feet, or 4 rods, which can cut-off valves which can sprinkling apparatus by t lengths of flexible The main is adapted short lengths to the inequalities of the ground by the insertion of elbows wherever they

are required. The arti-ficial rain is produced by rotary sprinklers, resembling monly used on lawns, and turned by the reaction of the stream of water. The sprinkler has two opposite arms, each of which is 5 meters (161/2) feet or 1 rod) long, and is perforated with a number of lateral orifices, while the terminal orifice projects a stream, radially, to a distance of one rod farther and a second terminal nozzle, which delivers a still more powerful stream, is automatically brought into operation four times in each revolution. The result is that the sprinkler waters an area four rods square. The sprinkler is connected to the middle of a horizontal pipe four rods long, which is mounted on a solidar pipe on rods long, which is modified on a single wheel, the whole constituting a sprinkling carriage, or unit of the system Similar carriages having pipes four rods long, without sprinklers, are used for connections.

A large field may, be conveniently watered with the aid of four sprinkling carriages and two pipe carriages. A sprinkling carriage is connected by short flexible hose to a valve of the main, and a second sprinkling carriage is similarly connected to the first one. To the same valve, but on the opposite side of the main (the east side, for example) is attached a chain of two pipe carriages and two sprinking car-riages. When the plots covered by the sprinkiers

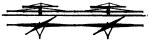


Fig. 3.—Elevation and plan of two coupled sprinkling

have been sufficiently watered, the six carriages are disconnected from the valve and dr rods to the next valve, by means of light cables and winches. By repeating these operations until the end of the main is reached, two strips of land, each tionary pipes may sometimes be preferable to one portable main. The pipes should be so constructed that they can be moved easily no that they can be used in different fields in different years, according to the crops planted.

As the wheels of the carriages are four rods apart and more than five feet in diameter, they do little damage to crops. The tracks made by the whole occupy only about one per cent of the total surface.

The Hartmann system of irrigation by artificial

rain is not very expensiva. An apparatus capable of delivering 700 gallons per minute, and including pipe delivering 700 gallons per misute, and including spressordient, when laid permanently, to supply 60 seros, costs less than \$4.000. The area served can be trebled or quadrupled by frequently shifting the pipes. With a flow of 700 gallons per minutes about 19 acress can slied with water equivalent to a reinfall of twofifth inch, in a working day of ten hours. In general it may be estimated that an artificial rainfall of twofifth inch costs about 50 cents per acre. The ex

periments already made show that this expense which includes an allow-ance for amortisation, is small in comparison with the increase in yield, which may exceed 100 per cent, even seasons which are not în ceedingly dry. The advantage derived from artificial rain in very dry years can scarcely be

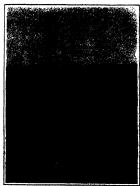


Fig. 1.—Portable main for production of artificial rain

Fig. 2.—Traction engine.

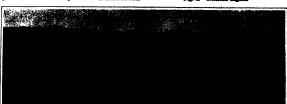


Fig. 4.—The line of sprinklers in operation.

MAKING RAIN WHEN IT IS DRY

eight rods wide, are watered. The main forms the eastern boundary of one water strip and is separated from the other by a dry strip eight rods wide, over which the non-sprinkling pipe ourrisages have traveled.

All of the carriages are then placed on light-wheeled trucks and moved eight rods westward, retaining their relative positions. This maneuver shifts the eastern pair of sprinkling carriages to the dry strip their relative positions. This majoriver shifts the eastern pair of specializing carriages to the dry strip just east of the main, the non-sprinkling plays say, riages to the watered strip west of the main, and the water pair of sprinkling carriages to the sant estate. The properties of sprinkling carriages to the sant estate, and the water pair of sprinkling carriages to the sant estate, and the insert carriages to the sant estate, and the line of carriages is drawn being. The same cause of the special carriage is drawn being. The presentation plant grows in the mand the water pair of the water of the sprinkling is designed to the sprinkling in the series of operations is repeated.

As yet in peace to under the same of the sprinkling is the series of operations is repeated.

The Resurrection Plant

THE Resurrection Plant, whose botanical name is the Anastatics, is sometimes called "
Rose of Jericho." r plant has been credited with so many ex-traordinary qualities, and none has been of greater service to quacks and charlatans over since its peculiarities

It has been called "the resurrection plant" by reason of the fact, that when apparently dead and dry it often assumes again the color of life as soon as its root plunged into water. buds swell with new life the leaves of its calyx open, the petals unfold, the flower stalk grows, and the full-blown flowers appear as if by magic. It is not, strictly speaking, a rose at all; the stem a rose at all; the stem divides at the base and bears spikes of pretty white flowers, which change into round fruits.

When ripe the leaves fall, the branches grow hard

and dry, and fold inward so as to form a bail.

In sutump_the plant is uproved by the storms and carried toward the cas. There it is suthered and expected to Europe, where it is highly pringle for its hydrometric qualities.

All that is necessary is to place the end of its root

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

THE vacuum jacketed bettle, so esthat boil at very low temperatures, and now so widely used by travelers and others, is a comparatively recent inven

The discovery that a vacuum space will revent the transmission of heat from one body to another undoubtedly was made by Dulong and Petit, but to Prof. Dewar belongs the credit of first mak-ing a practical use of this discovery. While investigating the physical proper-ties of hydrogenium in 1873, he used the calorimeter shown in Fig. 1. It is not stated what material the inner vessel is made of, but it probably was of metal. This inner vessel was secured in an outer brass cylinder, and the air between the two vessels was thoroughly exhausted. Although this first vacuum jacketed ves-sel proved very efficient and satisfactory, still there is no record of any atter being made to make further practical us of it until in 1887, when M. d'Arson in France, used a vacuum jacketed ves sel, apparently very similar to the one shown in Fig. 1, to store liquid air, and published an account of his work. It is probable that M. d'Arsonval was not aware of Dewar's calorimeter vessel, and was an independent inventor of the ves-

This metallic vessel, while quite efadapted for studying the properties of the liquids themselves. By 1893, many of the so-called permanent gases were be ing liquefied in considerable quantities, and scientists were sorely in need of a better vessel in order to properly carry forward their researches in low temperatures. Dewar, to whom the scientific world owes so much, undertook the problem of devising a new vessel. He im-proved the calorimeter vessel of 1878, by making it entirely of glass. These ne making it entirely or gisss. These new vessels which came to be known as "Dewar flasks" have many different forms, but the same principle is used in all of them, that is, they are made double, the inner vessel being united to the ou by fusing their necks together and the air between the two vessels is thoroughly exhausted. The forms of vessel most frequently used are those shown in Figs. 2, 8, and 4. The vacuum jacketed siphor tube (Fig. 5) is used for transferring liquid hydrogen from one vessel to another. If liquid hydrogen, which boils at -252 deg. C. or -421 deg. F., should be poured from one vessel to another, contact with the air would cause about nine-tenths of it to evaporate. To Prof. Dewar also belongs the credit for discovering that by silvering the facing surfaces of the vacuum space before exhausting and scaling, the empleany of the vessel was in-creased six-fold. It is hard to overesti-mate the importance of these fasts, for they are just as essential in low temper

they are just as sessential in low temper-ature researches. as the regenerative cooler of Elemens and Linds. "These vacuum jacktood vessels of Deview, as simple and yet no wonderfully officingle, were generally, considered to be too tragills for ordinary everyday use. When which a vessel was turned on the side, were brought at the contents, the leavement of the reset was often great working the contents of the contents. is to unuse the bottle to break.

Allet, Reinhold Burger, of Berlin,
includence of glass laberatory adense added to the glass vacuum

and reinet emilien features that

the most complete features.

protective casing and also placed small in making these bottles. In making these bottles. Many patents have been recently walls to relieve the strain on the neck granted on improvements in the support of the inner bottle. The courts in this lag devices and in the outer metal cases.

country and in England have held that ing, but no substantial additions have





Different forms of vacuum-jacketed ve

stor, 1878. S. 8. 4. Common forms of "Dewar flacks." 5. Va lacketed evolton.

ited to the supporting pad feature, and that there was no invention in merely changing the shape of the bottle or in adding the protective metal casing.

Supports between the walls obviously make the bottle less fragile, but they decrease the efficiency of the vacuum jacket, for they form bridges, as it were, for the direct transmission of heat from one wall to the ether. However, it was found that ficient for storing liquefied gases, was ill a fairly durable bottle could be made without using these supports, and, in the

Burger's patents on this bottle were lim | been made to the work of Dewar and

For some unaccountable reason, these bottles deteriorate in time. Although they may be thoroughly exhausted at the beginning, there can be no doubt that air is present in the vacuum space after the bottle has been in use for a considerable period. It is practically certain that this does not leak in through the glass walls. The most plausible explanation yet advanced is, that it is air which was oc-cluded on the surface of the glass, and absence of any flominating patents, many this view is apparently substantiated by

A polar automobile sleigh.

shape shown in Fig. 6, and added a metal | manufacturers were soon found engaged | the conduct of X-ray tubes By heating the glass during exhaustion, the dur-ability of the vacuum is greatly improved. However, to future inventors re-mains the problem of finding a way for removing all the residue. When this is accomplished, we will have probably the most perfect heat insulated vessel that it

A Polar Type of Automobile Sleigh

A NEW type of automobile has been constructed by a French maker who calls the vehicle a "Polar automobile The accompanying photographs show the peculiar features which should make the car very useful for winter tour ing, if not for Arctic exploration The large photograph gives a view of the vehicle when it is ready for use on roads not buried in snow in appearance and in construction it does not differ essen-tially from an ordinary racing car. For traveling in deep snow a shoe or skate is placed under each of the front wheels and clamped firmly to the wheel in the manner illustrated by the small central photograph, and two other shoes are lowered their double telescopic supports which embrace the rear axle, just inside of the wheels The rear shoes are lowered until, by pressing on the snow, they support almost the entire weight of the after part of the car The rear wheels are thus prevented from sinking deeply into the snow, but they graze its surface and penetrate sufficiently to continue to perform their function as driving wheels, as the chains with which they are wrapped act on the snow much as the paddles of a side wheel steamer act on the water The rear shoes are much longer and wider than the front shoes, pointed at both ends, and turned up slightly in front and sharply behind The short front shoes have sharp, high and decked prows which enable them to act as snow plows, while their rear are square and curved slightly ward. On each side of the car, a little in front of the rear wheels, is a pair of forks or claws, which can be raised or owered by means of a lever, as is shown in the upper left-hand photograph Each pair can be operated independently. When both pairs are depressed they act brakes, while steering is greatly facilitated by depressing the claws on one When the front shoes are not in use they are carried on the foot boards, as is shown in the large photograph.

Proposed Abrogation of the German-American Patent Treaty

In a cablegram from abroad, it is in-timated that the German Machine Manufacturers' Association has peti-tioned the imperial government in an effort to deprive Americans of the benefit of the treaty with Germany and seeking to secure a new law regulating pat-ents. The burden of the complaint apents The ourder of the compaint ap-pears to be that the Americans have an advantage in that they are not re-quired to manufacture in Germany while the Germana are Now, if we con-sider but a moment, we will recall that there is a true reciprocity. The German is not required by the United States man is not required by the united states patent laws to manufacture in the United States Therefore, the German government in waiving the requirement of manufacture by Americans, only extends to Americans the same privilege in Germany that America extends to Germans in America

In this view of the case, the complaint

COLD DISSON OF SAME OF STREET

does not seem well grounded. The treat; in question securing the rights to Americans in Germany corresponding to those enjoyed by Germans in America was fully considered by the lower hous in Germany when it was up for ap proval by the Reichstag, at which time the then Minister of the Interior and now Imperial Chancellor of Germany Bethman-Hollweg, advocated th treaty which was subsequently ratified by the imperial government.

In his report to Congress for 1910, Mr Commissioner Moore says this "treaty was entered into with the German em which, in its broad workings, had the effect of not only protecting the American inventor, but the German inventor as well. That treaty has been construed by the imperial court sitting at Leipzig, and its provisions were up-held in some of the patents which had been declared forfelted, and they were ordered to be restored by the German Patent Office"

The decision referred to in the Com missioner's report is the one in which the National Cash Register Company was a party and by which the patents were saved to the company A transfer of the patent was suggested by the plaintiff to the proceeding, and the court said, objection of the plaintiff to the taking over of the proceedings by the American company is therefore not to be con sidered, and said company being now glone sutherized to defend the natents must be admitted as principal party to the proceedings." The decision also says, "It therefore follows from the agreement that the compulsory working provided for in the German statutes can find no application when the patent be to a citizen of the United States Since his own country does not provide for compulsory working, he is, by virtue of his nationality, to be exempt from it also in Germany."

The cablegram asserts that a repre-

sentative of the government told the committee of the Roichstag that the e of the new measure before the Washington conference in May was regarded as absolutely necessary Apart from the power of the Reichstag to enact the legislation desired, it is by no means likely that an agreement solemnly entered into only little more than two years ago, and which was warmly advocated by the present Imperial Chancellor Germany, will be seriously affected by any adverse legislation at this time. In any event, the agreement cannot be abrogated before the May Congress convenes, as Article 2 of the agreement of 1909 provides that such agreement shall remain in force until the expiration of twelve months following the notice of termination given by one of the contracting parties.

Notes for Inventors

A Prize for a Horseshoe. - The Amerinciety for the Prevention of Cruelty to Animals has instituted a competition, offering, through one of its members, a prize of five hundred dollars (\$500.00) for the best horseshoe or device designed to prevent horses from slipping on paved streets: the conditions, which constitute an agreement between the donor of the prize, acting through the Society, and each competitor who makes a submission under its provisions, being as fol-lows: The competition is open to all without restriction; the right to reject any or all submissions is reserved by the Society, and the award will be made by the Board of Managers of the Society

The improvement may be submitted either by drawings, or a model, or both. cription should accompany each apa user-priora account accountant season as place peculiar construction of the tail of a philotation, stating, in detail, the meritg lobeter. Also that Brunel concerved the claimed for the invention, the material process he followed in tunneling understruction, and its estimated cost; in which the terede bored its way whether or not the invention is in actual through wood, and many other inuse or has been tested, and the results stances of the kind might be noted.

to wearing qualities, non-silt qualities, and other advantages. descriptive matter should be typewritten

although this is not compulsory.

Elach sheet of drawing and each model and all descriptive matter must be un singled, but must bear a device, cipher or emblem for identification; and the same device, cipher or emblem must be placed n a sealed envelope containing the comon a seared envelope containing the com-petitor's name and address, which en-velope will not be opened until the award has been made.

Drawings and models, with the acc panying envelopes, must be securely packed or wrapped and delivered at the office of the A. S. P. C. A., Madison Avenue and Twenty-sixth Street, New York. before 6 o'clock P. M. on Thursday, June 1st. 1911.

In making the award, the cost of the device, its wearing qualities, and all other points of merit, will be taken into consideration in addition to its non-slip ping qualities.

The competition is in charge of a mittee of which Henry Bergh, 50 Madion Avenue, New York city, is chairman

dardising Post Office Equipm The Postmaster-General by order dated January 4th, 1911, and amended February 6th, 1911, has appointed a commis to consider the standardizing of post office furniture and equipment and o prepare drawings and specifications of such furniture and equipment as may be found feasible to standardize and to submit the same to the Secretary of the Treasury and the Postmaster-General with appropriate recommendations.

The commission includes Charles F Trotter, assistant superintendent Divi-sion of Salaries and Allowances, Post Office Department; William H Haycock, superintendent of Delivery, Post Office, Washington, D. C.: George A. Gasman, assistant superintendent mails, Post Office, Chicago, Ill., and William E. Block, Postal Savings System, Post Office De partment, Washington, D. C.

Inventors and manufacturers pliances for use in post offices should appreciate a rather unusual opportunity, and those having improved devices either in the way of furniture or equip-ment, the latter being quite comprehensive, may be able to patent such improve ments and he in a way to secure a practically unlimited market, if able to secure adoption of the improvements by the

Patenting a Skeleton.—An interesting patent (983,547) was recently granted to a resident (Charles E. Fleck) of Orange, New Jersey, for an anatomical skel which is described as specially useful in connection with instruction and demon stration in the study and practice of osteopathy The invention is defined in part as an anatomical skeleton composed of a number of elements and comprising a spinal column composed of a numb of bones and means adapted to cons clastically the various elements and bones together, which is quite descriptive of the supporting framework we are all carrying around with us. The patent describes the invention as relating more particularly to improved methods ticulating the several bones in such a manner as to simulate closely the join-ing together of the bones in the living body. This patent emphasizes the important lessons that mechanics and inventors can learn from the study of the habits and operation of various insects and animals. It has been said that the special construction of the water main having universally jointed sections and by which water was conducted below the river Clyde, was suggested to Watt by the peculiar construction of the tail of a necessity because assessment of the process of the

rtaining to Apparel.

Persanating to Appareds
DUST-MOCAETN.—Sas E. WILTEN, West
ROZDUT, Mass., and HENRY M. WILTEN, I'M
McConnell Ribott, Chattanooga, Yuan. The invention shown in the accompanying Hinstration
has reference to monosains, the more particular purpose being to produce a mocasin sighable for childrens, and daspired to be worn over



DUST-MOCCASIN.

the shoes in carriages or cars, for the protec-tion of the clothing of the other people from mud or dirt often found upon the shoes of children. The lavention further comprehends a next form of moccasin cently and chasply constructed and having a suitable form to be quickly put on or taken off and easily carried in the pocket or the shopping bag.

Of Interest to Parmers

Of Insterest to Farmers,

RTRAINER,—T. H. Dizzing, and L. I., Ditons, Lamar, ind. This strainer is for use in
straining mile directly as the milk is milted
from the cow and thus preventing foreign matter, such as dandurf, fair, duut, etc., from entering the milk can, the strainer being provided with a waten pipe, through which the
foreign matter and milk foam are discharged
during miltime, No opportunity is afforded for
foreign particles dissolving or softening, when
the would not be removed by a strellar, as
her would not be removed by a strellar, as
later period.

Of Geberal Tax

OLDER FOR UMBRELLAS, ETC. -HENRY C. ENGILLERING, circ of North German Lloyd, 5 Broadway, N. Y. In carrying out the inven-tion shown in the engraving the holder is con-structed with two opposed laws which are pivoted and preferably connected together to move in unison. Underneath the laws is pro-



HOLDER FOR UMBRELLAS, MTC.

will guide the staff of the undrolls or other stick directly between the leave, irrespective of the careless manner to wiffer the article in translated. Preferably suspended from the bolder is a large hering; a fing besse linger theories and edupted to assume a horizontal position to be folded against the benger, and a drip pan central in the ring base.

drip pan sented in the oring base.

AMALIAMATOL—W. E. Brown, McAlester, any shock symmentices on the collection of the c

respect the street of the control of

Binardware,
DOOR STOP.—J. Sourcess, Wat Laiss, M. D.
An object of this inventor is to provide a
door stop for releasably securing a door to a
wall or the like, to hold the same in open
portion. For this purpose use is made of a
gripping member, and a trip number for rereading the former, to grip the door when the
trip member is engaged by the door.

Monschold Utility

Mounthoold Tublities.

And IRON HEATEN.—J. S. Gooses, TwreHaute, Ind. This invention provides a desble faced from and a beater supporting heading
to permit reversal of the Iron; provides for
iron while the lower is being ruftled in trening; provides an air-cooled handle to limit
heat transference from Iron to handle; and
provides an air-cooled sangle to handle and
provides an air-cooled supporting mamber for
the better within the handle.

the heater within the handle.

FLY TEAP—H. SAYLAR, New York, N. Y.
This invention refers to traps for catching
files and other insects and the life, and has
reference more particularly to a device comprising a civing, a movable member to attract
files and to curry them to a predestrained
point, a care, and means for disledging the
files from the first-mentioned member and for
directing them—into the cage.

Railways and Their Aco

Hallways and Their Accessories, CAR DOOR.—P. J. Hore, Kankake, Hi. The inventor's size is to previde a freight car door adapted to constitute a sung fitting closure member for the car and adapted to be releasably held in a lected position on the car. For this purpose, use is made of a rail, a supervisar means anounted to allide on the car. For this purpose, use is made of a rail, a supervisar means anounted to allide on the car. For this purpose, use is made to a rail, in gracular than the car. I have a supervisar the form of the car. I have a supervisar the car. I have door in a locked position.

door in a locked position

THE PLATE AND BRACE.—JOHN B R.
COUNN, Manassas, Virginia. Mr. Counts seeks
to provide means for provincing the ratia
from spreading and to se construct such means
that the heavier the weight or the greater the
force secreted on the ratia, the more closely
will the Draces at between the ratia and their



TIE PLATE AND BRACE.

supports, thus preventing the braces from slip-plag. The invention illustrated herewith also renders practicable the use of much solve wood for ties than now practicable, as well as smaller thes, and their life will be much increased as the splices will rarely, if ever, have to be removed.

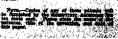
Pertaining to Vehicles

VEHICLE.—CARLOS ESCALAFTS, and JOSÉ P. SHEADO, 342 West 287d Street, New York, N. Y., and Apartado, 218, Merdia, Yucstan, Mez. Inlimited trouble is experienced by the wear of puennated tries, their susceptibility to puen



DEVICE FOR RESULTING SHOCK OR JAB

air to the three to preserve the object for which the three is constructed. In this 'investion shows, herewith a validate is provided have to construct a relative in provided and the state of the stat



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A STATE OF STREET OF STREET

(13432) J. M. H. asks: I have been looking for some time for an explanation of the chemical theory of the Nodon vaive or rectifier in which aimminium and lead plates and amonatum planeplate are used to convert an amonatum planeplate are used to convert as measurement of the second plane in the convert and the convert and the convert which the second convert which the second convert which place is lead plates in due to the fact that the element of the alternating current which passes in at the lead plates in due to the resistance from the plane; but the element of the second convert which the second convert which the second convertible (12432) J. M. H. asks. I have been

are in fully described and the count-access griven, with drawings and specifications (12433) L. F. P. asks: In the issue of January 2184 was query No. 1285. relative of January 2184 was query No. 1285. relative clemed in an aluminium kettle. The answer to this is that the action in electrical, and the surface of the silver is removed and a fresh surface of silver left. Now what pumiles most simply that the discoloration is removed, and leaves, not a new silver surface, but the same silver (cleaned and freshmend A. By "fresh surface" of silver is the continuous control of the silver left after the cotening, we represent the control of the surface of silver is left, exposed. In time this will remove an appreciative portion of the silver, but the silver taken Nor is there are solution, which will remove the dirt and translat from silver by more immention, unloss it is an arch unflicentry strong to dislowly assess of the silver and in line-tension. to dissolve some of the silver and make the surface of the silver rough make the surface of the silver rough We do not suppose you referred to any such solution in your inquity, but to a solution which would not harm the article We should answer the same now There is no solution which will make a new pollsh on allver by immersion simply which will not dissolve of some of the sliver also, and injure the article

simply which will not dissolve off some of the silver aise, and injure the article (1243) A. W. A writes: Will you please give me information as to how banann oil is made, and what part of the piant is larger to be seen to be successful to the properties of the piant is any other suitance than the banana? Is there a reatise published on its manufacture? Any information will be appreciated A. Bianana oil is the name given to an artificial fruit flavor, with a consists of a mixture of any from the banana or any part of the banana (rec. Any) a cavate, the principal component is made from purified fored oil by distilling it with arrong subplant acid and seloum acetata. What is a substantial of the substantial o

12.485 G. W. M. asks: It is desired to pump water ever a bill seed 350 feet high and the control of the control (12435) G. W M asks: It is desired



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Light and Shudows (Continued from page \$16.)

getten from the several views of re-lighted by these fixtures above. It with. The simple style of fixtures in shown in the filteration of the efficien-the Hamilton National Bank of Chica

amel down to the wainsectins, which is marble.

In the home we generally wast bright light only over a small space such as the dining table, the dressing table or the reading chair, while a very low intensity suffices in other parts of the room. Even when a whole room is to be lighted, when a whole room is to be lighted, or the latest the room in the lighted probabled by a number of small lamps than by a stagle large one, and smally it is preferable to avoid glare by use of shades rather thap by indirect lighting. In some cases, however, as for instance when the number of outsite is limited, it may be advisable to use a single large high-disciency lamp in an indirect light and and a good reflector is used, one 100-wait lamp will light a room fitteen feet square or smaller fairly well; if more outless are available a still more attractive of feet is obtained by using a somewhat smaller lamp for the indirect fixture, supplementing it with one or two small direct lights.

plementing it with one or two small di-rect lights.

While most of us have a prediction for the shaded direct lamp, illumination is, after all, largely a matter of tasts, and it must be admitted that most charm-ing results can be obtained by indirect lighting in the home. Light walls are by no means indispensable; for example, in the living room shown, which is 15 × 22 feet, the walls and hangings are dark green, yet the two-light future gives an illumination by which fine print can be read with perfect case. The dining room given is an extreme case in that all the finishing except the purels of the soling is very dark. Even here four 60-watt lamps are sufficient for a room 18 × 20 feet.

that either two, four, or all six may be used. Similarly the land of the cover of the "direct-indirect," and white it is necessarily less efficient, in the en gineer's sense of the word, than well-planned in the land of the cover of the co

arbon lamps. In the Hamilton National Bank the inin the Hamilton National Sank the in direct system is not merely more satis factory, but actually uses 30 per cent less power than the former direct installation

power than the former direct installation. In conclusion it may be said that the problems of illuminating engineering are far from solution, and opinions differ widely as to the relative merits of various plans and devices. It would be premature to assign to judirect lighting a definite rank, but it is certainly worthy of serious consideration for its artistic possibilities and as a long step forward in the movement toward the conservation of cresight. in the move of eyesight

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badly and beyond reasonable remedy, the contract witi be cancaled. There are certain difficulties in the way that retard the general adoption of such a specification in the purchase of cool. The most serious of these difficulties is the collection of a fair sample of the coal to be analyzed. This is especially true where the sample must be collected from coal already loaded in cars, on board serious of the coal to be analyzed. This is especially true where the sample must be collected from coal already loaded in cars, on board serious of the coal to be analyzed. The sample is fair and the coal to be compared to the coal to be compared to the coal to be compared to the coal to be coally analyzed to the coal to be coally analyzed to the coal to be coally analyzed coulpment and standard methods should be used—and by experienced chemitst.

standard methods should be used—and by experienced chemists.

The product from a chemists with the standard methods should be used—and by experienced chemists with the efficiency with which a given coal will burn in the furnace, the greatest factor of uncertainty is the behavior of the salt; whether or not it will melt and form a sing on the grate bars. Another factor of uncertainty is the behavior of the coal (itself; whether it will cake on the upper surface in burning sufficiently to interfere with the draft (and the combustion).

tion). When our knowledge concerning this and other less important matters is advanced sufficiently, instead of purchasing coal as we now do at a given price per ton, we will be able to purchase it on the basis of a given price per one thousand heat units. heat units.

Heating the Home tinued from page \$78.)

pense and insure successful operation. Consider the climate of the locality, the Consider the climate of the locality, the imperature, whether mild or extremely cold, the location of the house, whether detached or in an exposed position, the size and height of the chimner, the height of the cellar ceiling, the amount of glass or window exposure. Allows ances should be made for loosely fitting windows, etc. Pinality consider the fuel at hand. Tabulate these details and sub-Windows, etc. Finally consider use rues at hand. Tabulist these details and submit them to the heater manufacturer. If the stories (any climate) the hot air furness stories (any climate) the hot air furness will provide ample heat and prove satisfactorily economical and lowest in cost of installing. It has much to commend it for this class of heating. It is simple with practically nothing to go wrong, and the repairs are low in cost and readily made. See to it that all pipes and the repairs are low in cost and readily made. See to it that all pipes and the repairs are low in cost and readily made. See to it that all pipes upon the control of the comment of the cost of t loug and narrow place the heater as indicated, thus permitting all pipes to be
given a sharp upward rise. (See Figs.
3 and 4.) If the ceiling is low set the
furnace in a pit to necessary depth to
give upward siant to all pipes as they
leave the furnace. Fit a baffle plate as
shown in Fig. 3 to extend into furnace.
It will cause the air to be distributed
over a greater section of the furnace
beating surface. As now generally finheating drum, up one side of the furnace
in a compact thick body, thus only its
outer skin is warmed. This baffle plate
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and the indirect-descring method.

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merally installed. The direct-indirect meth

or hot water accomplishes the same want as the indirect system when provided with some independent form of vertical control of with the direct-instruct method (Fig. 5) from air is taken through the (Fig. 5) fresh air is taken through the wall from out doors, at the bottem of radiators, and is heated by passing up through the radiators into the room. Individual regulation of temperatures in each room care behad by a convenious damper, arranged to cut off outside air and permit circulation in the room. Fresh air circulation is readily secured

and permit circulation in the rooms. Fresh air circulation is resulty secured with this system, the lose of space occupied by the radiators and the increased operating cost being the sole disadvantages. The direct-indirect system relations and direct-indirect system relations are black than the indirect system. In the indirect method (Fig. 6) used with atom or hot water the radiators are placed in a box, compartment or small room—on the collar or any convenient place, below the room to be heated. Fresh air from outdoors enters and the relation of the state of heating is more expensive to operation than the direct or direct-indirect system. Where space is at a premium and a good circulation of air is essential this system is unsurpassed. However, greatly increased boiler and radiating surfaces are necessary where this system is unsurpassed. However, greatly increased boiler and radiating surfaces are necessary where this system is unsurpassed. However, greatly increased boiler and radiating surfaces are necessary where this system is unsurpassed. However, greatly increased boiler and radiating surfaces are necessary where this system.

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ture. Heating by electricity is the most attractive heating method yet devised, but unfortunately the cost of electricity is as yet too high for general use. Its convenience for chilly days—when a furnace fire is not warranted—is, when one takes into account its cleanlines, the most valuable addition to any heating system. In the convenience of the conv

steam. The slight pressure at which steam is used in home beating plants easily over-cemes many conditions that are often fatal atumbling blocks to the successful operation of hot water systems. Abrupt bends, numerous difficult turns often necessary to place radiators in desired positions, impede water circulation, but positions, impode water circulation, but do not appreciably affect the travel of steam under the pressure generated in home heating plants. The use of steam with the direct method of heating re-quires only single lines of vertical piping above the cellar connecting the boiler direct with the radiators placed in the rooms.

above the cellar connecting the holler direct with the radiators placed in the rooms.

It is the most simple system, as no top floor or attice plping or fittings are required with steem, as it he case with hot water systems. Hot water used in the direct heating method requires radiators with about fifty per cent more radiating surface than is required for steam, and the steem of the steam of the results and a contract of the same temperature as with steam. With the direct method, the added space occupied by the increase in size of radiators with hot water is offset in the opition of many, by the evenues, of the heat and slight attention required. The fact that hot water radiators retain some warmth over night, even though drafts are out off, particularly commends it, as the house never becomes entirely child. This convariance is greatly in its favor, so we must be governed by the supply at hand, and it is well to keep this is mind when purchasing. If it is desired to burn soft coal, a larger grate surface is required, due to the becomed draft by earling of the coal. A larger grate surface is also becomes rety to fine, head out, such as a part of the second of the steep is such as a part of the second of the surface of the specific of the coal. A larger grate surface is also becomes rety of the second out.











GRAY MOTOR CO. 121 LOS. N WITTE ENGINES Borneyerer of Average; pares of Average; pares Character Booted price

RUBBER WILL

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is most wasteful, producing the poor radiating surface. Trouble Chart.—Hammering in ra Trouble Chart.—Hammering in radiators and piping is due to a vacuum caused by water accumulating to such as exceed to or culckly condenne some of control of the condenne some of Chart.—Hammering in radisystem, clean out the valve and unscrew the valve seat until the steam escapes rapidly. Permit the flow to continue for a minute or two, then sorew down the valve seat until the steam is just cut off.

for the efficient conduct of their busi-

nesses.

The most efficient tungsten incandes, cent lamps of the General Electric Company consume 1 to 1.28 watts per horisontal candle power—a very low figure compared with the 3.1 to 3.5 watts per candle of the graphitised carbon lamp. The effectiveness of all electric light sources is increased by the intelligitation of certain new shades and reflection to certain new shades and reflective the light in any desired direction by the reflective and refractive which throw the light in any desired direction by the reflective and refractive

sent application of certain new shades and reflector for distributing the light and reflector with the light in any desired effect of a set of prisms formed in the surface of the glass, and radial wave reflect of a set of prisms formed in the surface of the glass, and radial wave reflect of a set of prisms formed in the surface of the glass, and radial wave reflector, which increase the efficiency for street lighting by scattering the light over a large area.

One drawback of ungeten lamps hitherio has been the fragility of the flishments of lamps for ordinary voltages. The following the flight of the surface of the surface of the lighting that the laboratory of the National Electric Lamp Association—and improved methods of anchoring the finment mark the highest development of this lighting unit. They permit the construction of a highe-voltage lamp which compares favorably as regards the robustness of the liment with the most approach the prisms of the flight of the operation of the control of the light of the prisms of the flight to be operated at a high temperature (5,000 or 6,000 or 6,000 or control of the control of the lighting of the ultraviolet rays in troduced for street lighting in Parts last summer, notwithstanding the fragility of the quarts tubes and the supposed necessity of cutting off the ultraviolet rays of the control of the control of the quarts tubes and the supposed necessity of cutting off the ultraviolet rays of the quarts tubes and the supposed necessity of cutting off the ultraviolet rays. the quartz tubes and the supposed necessity of cutting off the ultra-violet rays emitted by the mercury arc and which pass readily through the quartz tube.

pass readily through the quartz tube.

Among new electric lamps which have
not as yet been put into commercial use
is an arc lamp having a negative electrode of titanium carbide placed below
a non-wasting copper positive electrode,
and giving a light which is almost pure
white. Dr Charles P Steinmets has
recently patented an arc lamp having one
electrode of mercury and one of alumirecently patented an arc lamp having one electrode of mercury and one of aluminium. An incandescent tamp, utilizing a highly refractory filament which is so alowly exidized that it can burn for a considerable number of hours without a vacuum globe, was announced a few years ago by its American inventors. Meagra, Parker and Clarke. The specific resistance of the filament, which consisting, was stated to be about fifty times that of an ordinary carbon filament and several hundred times that of the tungsten lamp, and its hardness is claimed to be so great that it would creatch glass. But if electrical methods of lighting have made great strides, progress has have made great strides, progress has not been wanting in the field of other

rapidly. Permit the flow to continue for minute or two, then server down the valve seat until the steam is just cut off.

Lamps of To-day
(Constead from page 179)
she may imaged: it by daylight, since the amount of daylight that penetrates into modified chemical composition differing the store, or the artificial lighting, does not satisfy the cyre when it comes to deciding on the color and tenture of the deciding on the color and tenture of the daylight has penetrates into modified chemical composition differing from the ordinary thorium-certum formula and giving a warmer, more minute and color type angraver is masked to the color and tenture of the daylight hours. The stretching out the daylight hours. The production of and and days or the owner of the daylight hours. The production of and manutes (20 to 40 camposition who find the light failing them in the full swing of their work, may by its add to take a stretching out the daylight hours. The portrait painter and the photographer, driving the strength Small sizes of the full swing of their work, may by its add to the stretching out the daylight hours. The portrait painter and the photographer, driving the strength Small sizes of the full swing of their work, may by its add to the stretching out of the daylight hours. The world almost and manutes (20 to 40 camposition who find the light failing to men in the full swing of their work, may by its add to the swing the strength Small sizes of the strength st The light of the tungsten lamp has



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rom ash pit to ash can. Disposes of un-Stops dust numance every time you shake it, floating dust that sifts no there. ine, floating dust that afts up three peries. In fact it is such a composite of it before.

yricanas i by Architects and Hesting Engineers. When you consider the saving of the features of cleanlones and santation, but on the matter but already installed in many found on the matter but already installed in many homes where owners would not be without it. Year dusive can found supply below to be the up to the owner of the control of the cont

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tage, giving a more harmonious effect and better distribution of illumination than is possible from a single ordinary-sized burner. High-pressure gas for street lighting with incandescent manand the state of t Inner one passing through the meshes of the outer one and the combined light emission being greater than that given

of the outer one and the combined light emission being greater than that given by a single mantle. Blaugas, to which the name "bottled sunshine" has been applied, is a heating chieffy remarkable for the animamoner of its application. It is sold in lique-fied form in strong steel tanks or bottlee 8 inches in diameter and 4 feet high, containing 30 pounds of the gas. It is stated that one pound of this gas, costing ten cents, will keep an ordinary 60-candispower gas mantle burning for 17 hours, ordinary for the containing 30 pounds of the gas, costing ten cents, will keep an ordinary 60-candispower gas mantle burning for 17 hours, ordinary containing 30 pounds of the gas and the courts of about 1,00 or the gas the courts where there is no central gas plant with street mains. The equipment for using it consists or a small steet cashinet in-stalled just outside the house, holding tank from which the bouse piping is supplied. An improvement in lighting by density

two bottles of the gas and an expansion tank from which the bouse piping is supplied. An improvement in lighting by denomination of the control of the contr

vapor.

The present improvement consists
in a gravity feed from a reservoir
above the burner, delivering the vapor
to an inverted mantle and doing away
with the wick and the priming pump.
In the overhead lamp designed for outdoor and lance samp designed for outdoor and lance samp designed. In the overhead lamps designed for out-door and indoor use, a pull on the hang-ing chain permits the priming charge to run down on to the beating surface, and in a few seconds the vapor generated ignites at the outlet of a Bunsen burner giving a hot fame which brings the man-tic to full incandescence. A mantie of \$90 per cent thorium and 1 per cent cert-um on a rante filter have the semblered. um, on a ramie fiber base. is employed. The outdoor lamp is of windproof cor

Light and Power on the Farm

the best continued with feasible transmission distance within feasible transmission distance or control station, or early square treatment of the feasible transmission distance or control station, or early system, from either of which sources current may be had without the installation of a private generating plant. The charge for electricity from such a source is often high, and the service is not especially reliable, but, nevertheless, these faults are not necessarily serious, as the uses to which the small farmer would have occasion to apply electricity are principally for lighting, separating and churring. High latific work, feed grinding, clipping and grooming, wood sawing, grindstone work, and the usual domestic conveniences, laundry work, sewing me. the best results. The small farm is genconveniences, laundry work, sewing ma-chine work, ice cream freezing and many other devices requiring small amount of power, also the tossing, cooking and

heating articles now made by ex nanufacturers.

manufacturers.
It is the larger farm proposition that
offers the greater opportunity for the
application of electricity, for not only
are the various domestic conveniences
desired, but in the farming operations
there is a real opportunity to increase
the rate of output and decrease the
amount of labor involved in producting amount of isbor involved in promoting the crops, transporting labor and ma-terials in the fields and buildings, plow-ing, threshing, silage making, milking pumping, refrigerating, and incubating.

pumping, refrigerating, and insubsting. With an equipment producing the most modern method of accomplishing all the operations that go to make up the routine of a grain, dairy or stock farm, the owner can afford to, employ skilled labor and just as much of it as he can provide productive work for, because in this way the profits will be greater through increased output and the fields will have to be attinuisted to their utmost to produce the material necessary to keep the machines up to a fall period of newardine.

of operation. The xep note then becomes reliability of operation. This means adherence to a definite schedule of work, the substitution of more capable labor in the place of the unskilled farm worker, and the adoption of highly efficient mechanical devices which will eliminate, either wholly or in part, manual labor and accorpilsh, the streen time, results that the complete of the streen time, results that we have a support of the streen time, results that the streen time, in the streen time, in the streen time, in the streen time, the streen time and accorpilation would have seemed amazing.

It is no longer a matter of prophecy to It is no longer a matter of prophecy to say that electricity on the farm will do these things, for it has been proven, and svery faxy the warps in which advantage may be taken of the usefulness of this great force are becoming more and more numerous. The saving in labor cost of a dering of other economics in production and it of the greatest importance to the farmer.

make it of the greatest importance to the farmer. The important applications of elec-tricity on the farm have been prastly well described and demonstrated in agricul-tures on the subject. The salient points which have been brought out by these demonstrations being:

demonstrations being:
Electric lighting and motor drive for all extensive field and barn operations is feasible with the apparations over the feasible with the apparation of the feasible with the sparation of the feasible of the feasible of the feasible only with electric and power, as is possible only with electric than the feasible only with electric and the feasible only with electric and the feasible only with electric than the feasible only with electric than the feasible only with electric than the state of the feasible only with electric than the state of the feasible only with electric than the state of the feasible only with electric than the state of the feasible only with the feasible only wi

The use of electric power as a substi-tute for the individual engines often in stalled in barns and outbuildings has the advantage of greater reliability, safety, cleanliness and fexibility in application. The expense of electric wiring and mo-

The expense or electric wring and mo-tor equipments are not excessive as com-pared with the cost of other equipments. The installation of electrical apparatus on any farm will pay for itself in the saving over the old method in the first

The economy of the proposition is the

The economy of the proposition is the strongest argument. For those farms on which central station current cannot be obtained or for problems of any considerable size, involving one hundred acree or more, generating sets, utilising prime movers must be installed.

be installed.

The accompanying illustrations show the apparatus which should be included in a well ordered plant of this kind.

For the farm equipped with stantibuler, or accessible to cheap tuel, the small steam engine or turbing generator sets are the most suitable, but, for the majority of farms this is not the condition, and the gasoline, kerosene, or other fuel oil, internal combustion eagins is more appropriate, on account of its greater simplicity and safety.

Two of the accompanying illustrations show typical generating units of this kind.

With the private electric plant there With the private electric plant there is the utmost need for a proper planning before the apparatus is ordered, as the standards of mantheurer in this particular class of machinery effer an underto mumber of sizes and gives to select front, each combination having certain limitations and possibly a particular purpose, thus making it a very cest thing top.



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the presence of the control grants are also made in the control grants are also made and present a second grants are also made in the control grants are also made in the control grants are also made in the control grants and in the control grants are also made and a control grants are also made in the control grants

servios.

An important item of the farm equipment that should be placed in the electric plant and always kept in immediately operative condition is a pressure pump of sufficient capacity to provide ample fire protection for all buildings and crops in storage. The value of property lost by fire can be recovered from insurance, but the loss of the opportunity for profit from bundless during the period of the building is not so easily taken nara of

Fig. 3 illustrates an ideal pumping equipment for this purpose, as it may be driven by either the internal combus-tion engine with which it is directly tion engine with which it is directly connected, or by an electric motor which cannot be distinguished, owing to the point from which the photograph was taken. With this equipment, if the elec-tric generating apparatus is not running, the pump may be operated for its ordi-nary dates by its own gasoline engine, or from the storage battory, which latter,

ANIMA

aracteristic feature of that particula

a characteristic feature of that particular body and not a general temperature effect. The possibility, herefore, exists effect. The possibility and the process of the product of the process of the product of the pro

page of electricity to a large group or farm buildings.

Tig. 3 likewise a smaller and less as we type of which has recently been elaborated set cannot the secretary and the secretary which serves as an excellent anuillary in tansilations of this kind, is located in the engine room, but it is in located in the engine room, but it is in located in the engine room, but it is in located in the engine room, but it is in located in the engine room, but it is in located in the engine room, but it is in order to accertain whether or not lamp is efficient or not, whether a new plant and the power of the saft frames.

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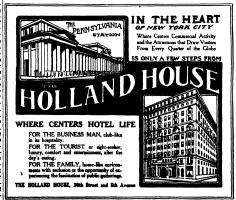
There are many forms which the power of the saft frames that the saft in the saft in

no mean order.

Although these light-measurers or photometers differ in form, the underlying principle and mathematical law on which tometers differ in form, the underlying principle and mathematical law on which they are based is usually the same. According to that law the illumination of a surface is proportional to the power of the source of light divided by the square of its distance from the surface. Among the many photometers based on this law the many botometers based on the law of the many should be a surface. Among the many should be supposed to the many should be a surface of the many should be supposed part appearing dark when viewed from that side of the lamp, which produces the stronger illumination at the position of the paper, and as light spot when viewed from the opposite side, although it is still used in commercial work, fitted with the Ruedorff mirrors, nowadays the photometer of Lummer and Brodhun is extensively used, in which, instead of a grease spot, two rectangular prisms are employed, total reflection and total transmission taking the place of partial reflection and transmission taking the place of partial reflection and transmission taking mission in Busens's photometer, so that tric generating apparatus is not running, the pump may be operated for its, ordinary duties by its own pasoline engine, or from the storage battery, which latter, however is not so efficient a method. The properties of the proper storage is not so efficient a method. The properties of the proper storage is not so efficient a method the proper storage is not so efficient a method the proper storage is not so efficient a method the proper storage is not so efficient a method the proper storage is not so expected the proper materials. The temperature of the proper materials. The temperature of and also by increasing the rapidity of combustion. The temperature of the proper materials as and also by increasing the rapidity of combustion. The temperature of the proper materials as a soft higher energy, such as acceptence, and also by increasing the rapidity of combustion. The temperature of the proper materials and the proper materials as a soft higher energy such as acceptence, and also by increasing the rapidity of combustion. The temperature of the proper materials is not some more results in the case of the proper materials and the proper materials. The temperature of the proper materials is not some more results in the case of the proper materials and the proper materials. The temperature of the proper materials are properties in a such as a settlement of the proper materials of the such as a settlement of the proper materials and the proper materials and the proper materials are the proper materials. The temperature of the proper materials are properties in a such as a settlement of the proper materials and the proper materials are properties in a such as a settlement of the properties of the









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portant questions still remain. One of prime importance is whether lights differing widely in color from daylight are harmful to the ere. It is only by the acquisition of exact data that he part played by high intrinsic brilliancy, intra-roler redilation, and the like can be understood. Investigations such as these can be conducted only intra-roler redilation, and the like can be understood. Investigations under these con the conducted only of the control of the fatter will be produced in accordance with principles discovered by pure science in laboratories founded with no commercial end in view. There has been developed as yet, no simple means of measuring an artificial light source in such a manner that a numerical value can be given to its approach in quality to daylight. In other words, there has been no basis for estimating the daylight efficiency it is obviously one of the duties of the physicist to provide such as heartistly afteriord, but historious the historious the historious the historious the historious the historious that historious the historious the historious that historious the historious the historious that historious that historious that historious that his historious that historious that his historious that historious that his historious that his historious that his historious that his historious historious historious historious histor portant questions still remain.

must solve many a difficult problem involving color before we can arrive at the artificial sunlight of the future. What is the physiological affect of a light rich in ultra-violet rays? What is the effect of vision at the center of the retina when the source of light its directly in the field of view, and when it is placed to one side? These are important questions which only the physiologist and psychologist can answer before the engi-

physiological subject of The one physiological subject of "glare" alone has involved a varat amount of painstaking study, novel in its char-acter. There are twelve evenmucles, six for each eye. It is their function to turn the eyebal is othat its axis may point (within limits) in any direction. To see fine detail it is necessary that the image of the object of vision fall on a very limited portion of the veilus known as limited portion of the retina known as limited portion of the retina known as the "foves," specialized for distinct viaion. This happens when a person looks directly at an object, and must obviously occur alike for both eyes, wherever the object is, so that the object of direct vision always falls on the foves of each eye. The result is that limages of other objects not directly looked at will other objects not directly looked at will fail on corresponding points of the two retinas. Now, the difficult task is thrown on these twoler nurcles of accurately placing the images in the two eyes on corresponding points of the two retinas, whether the object be far or near, up or down, or off at one side, and the move-ment of acrommodation must take place at the same time as the two eyes are di fect. The eyes must be focused alike and accurately converged in order that their axes may meet at the object of direct axes may meet at the object of direct vision 80 perfectly do these muscles perform all these delicate adjustments, without the least knowledge of the fact on our part, that when the image in one eye is displaced by holding a prism of three or four degrees deflection before the eye, the muscles at once make the necessary adjustment, and the knowlthe eye, the muscles at once make the necessary adjustment, and the knowl-edge of it is the disagreeable pull feit in the eye as the muscles assume the unusual strain We have to do here with a most complicated and delicately balanced set of lauscles and nervous constraints of the experimental control of the e may cause such confusion of the various eye movements as to make vision well nigh impossible Factors such as these must be considered in studying glare and in distributing light, in the proper way for practical illumination. Hence, their importance to engineers and lawmakers and to any man who seeks to improve

Evidently, the light of the future must be safe of our eye troubles are due to in-correct lighting. It is not known exbe any many of our eye troubles are use correct lighting. It is not known excorrect lighting. It is not known exactly to what extent eve injury may scription.

arise from degrees of intensity, or to
the street from spectral composition.

An Autorophysical Chescratory in Meshausen, an expineer in German, have
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hausen, are inputed to the first hausen in medical contexts, it is found in many actiquantities as it is found in many actidial sources, is positively harmful and
should be eliminated. The presentation
should be eliminated. The presentation
should be eliminated. The presentation should be eliminated. The presentation of the strength of the streng

nical bodies has called forth a storm of protest. In particular, Dr. Yooge, of the Stantialboratorium, of Hamburg, has published the results of numerous ex-periments to show that in daylight libral mination, under comparable conditions, there is more ultra-violet light than in those artificial sources which were found harmful by Drs. Belans and Stockfound narmful by Drs. Bonana and Broos-hausen. What conclusion, if any, shall we draw? Only the physiologist unfec-tered by commercial considerations can

answer.

In order to see, we are not so much concerned with the amount of light that falls upon an object as with the amount of light that reaches the eye after having been thrown back from the illuminated object. Investigations such as these seem can be given to its approach in quality object. Investigations such as these seem to daylight. In other words, there has properly to fall in the province of the been no basis for estimating the daylight illuminating engineer. Yet there is a duties of the physicist to provide such a be done before we can distribute our basis. That object has been at least future light in the proper way. Here partially attained in the laboratory at apartially attained in the laboratory at partially attained in the laboratory at most offense, and not engineering, sity of a physical taboratory which shall must solve many a difficult problem in-conduct its investigations free from comvolving color before we can arrive at the mercial bias.

The Current Supplement

A CRYSTAL arouses the interest of the observer, not only by the regularity of its forms, the perfection of its larity of its forms, the perfection of its surfaces and angles, its transgessence, and its brilliance, but also by the manner in which it grows, heals its wounds, is dissolved, and modified under the influ-ence of the inclosing medium. All these phases of crystal life, if so it may be called, are admirably discussed by Dr. Paul Gaubert in the current Supplement Paul Gaubert in the current Supplements.

No. 1841—An eloquent address on language and literature was delivered not so long ago by Lord Morley. Parts of the address dealt with the relation between science and letters and are commented upon in the current Supplements.—Mr. Walter V. Tunner's paper on "The Africation" to concluded—More Interesting the processing Locomocition". tion" is concluded.—Most interesting, both because of its manner of presenta-tion and because of its remarkable illustrations, is an article by Mr. A. Hooton Blackiston on Antigua, a remark-able Central American city of historical interest.—A paper recently read by Har-rington Emerson, the eminent efficiency engineer, before Harvard Univer "Securing Efficiency in Railroad is published -The Hanriot monoplane is described, and detail drawings of its con-struction published.—Mr. W. C. Gets con-tributes a good article on the working distances of wireless stations.—The pollution of our streams by sewage tion of our streams by sewage and trade wastes has become a national is-sue. Hence, Mr H. de V. Parsons's scathing paper entitled "Our Typhold Streams" should be read with profit.

Tipping the Shores of Hudson Bay

A VERY curious result of the slow change of level going on at various points of the earth's surface is the gradpoints of the earth's surface is the grad-ual tipping up of the shores of Hudson Bay, just as if some gigantic power were engaged in an attempt to empty that great basis of water into the adjoin-ing sea. One of the earliest indications of what was transpiring in this connec-tion came to the notice of the officers of the connection of the connec-tion that the safer at the months of found that the safer at the months of the rivers where their nosts were sixfound that the water at the mouths of the rivers where their posts were sta-tioned was gradually getting shallower and navigation consequently becoming more difficult. Examination showed that the shore is lined with old beaches of in digricings gight, in the proper way the shore is lined with old beaches of for practical limination. Hence, their sand and gravel jving as high as fitty importance to engineers and iswamskers feet or more above the present level of and to any man who seeks to improve the bay. When Hendrik Hodson, in present methods of producing and using 1510, discovered the great body of water than the same of the present with his control with his control water than the proper way the same has witnered with his ships on the east coast of the bay in a harbor which has now disappeared, or at least has been so far drained off as no

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is set aside for the establishment at Jon-don University of a chair of eugenics It was Gaiton's idea that data should be collected which would help along the cause of eugenics With characteristic thoroughness, he provided means for ren-dering the information accessible to scientific workers in the field.

Constion of Work at Arequips.—Prof. E. C. Pickering, director of the Harvard Astronomical Observatory, states in his annual report that it will be necessary annual report that it will be necessary to abandon the work at Arequipa, Peru, for lack of funds. We share his hope that only a partial abandonment of the work there will be necessary, until some broad-minded man of wealth will furnish the necessary money to carry on investigations in the southern hemisphere, where little astronomical work is done.

The Department of Agriculture and New Fruits.—The attention of the De-partment of Agriculture has been called to a dispatch published in various California papers stating that the department had originated a new type of navel orange and that several thousand young trees were ready for distribution this month throughout California. These statements as published are misleading and are apparently based on a misappre hension of the facts. The department has hemsion of the facts. The department has no new navel oranges nor new circus no new navel oranges nor new circus (California at present. Experiments in the breeding of new navel oranges and other circus fruits have been under way. 349, while the January total was \$1.633. The record for February was \$1.633. The record for February however, are attill in the preliminary stage. None is a list of the principal countries to of the new sorts will be distributed until the formulate. None that the preliminary stage. None is the distributed until the suppless of the department and found to be departme

Marketing a Glacier.—The rather poetic term houille blanche ("white coal") is applied in France to the Alpine glacier

Electricity

Science Sapanese Lacquer.—Aspanese lacquer is held to be the most beautiful material of the kind in the world. It has recently science on its own account, and has been the subject of a special study by German chemists, the result of whose in the Valence of the contract of the contract

Measuring the Bore of Fine Capillary Tubes.—The task of measuring the inside diameter of a capillary tube is a very delicate one. The usual method consists in measuring it optically with a microscope and micrometer evenices, or by filling it with a measured weight of mercury, and determining the space occupied by this quantity of mercury in the capited of the capited in the capited in the capited by the capited in the capited in the capited by the capited in the capi resistance way of measuring the tube, but it is open to one difficulty. The tube must be kept perfectly clean and free from moisture, so that the resistance will give a true measure of the diameter of

Electrical Exports in February.—According to statistics furnished by the government for February last, there has been a falling off of electrical exports as compared with the first month of the

	Bioctrical	Electrical
Exported to-	Appliances.	Machinery
United Kingdom	\$32,170	\$49,331
Canada	268,238	130,002
Mexico	85,551	67,437
Cuba	42,274	30,180
Brazil	187,730	2,873
Rest of South America	101,030	33,838
Japan	71,316	109,048

Marketing a Glacier.—The rather posite term noulliblishment ("white coar")
is applied in France to the Alpine glacier
ing the companies of the second of the companies of the Harriman incompanies of the glacier lee is sent to Lyons overy aument it is remarkable for its extreme purity. The lee is detached in drilled holes. Dynamite was tried, satisfact the companies of the glacier lee is sent to Lyons overy aument it is remarkable for its extreme purity. The lee is detached in drilled holes. Dynamite was tried, satisfact as the y exploiting run powder in drilled holes. Dynamite was tried, suitable site by exploiting run powder in drilled holes. Dynamite was tried, suitable site by exploiting run powder in drilled holes. Dynamite was tried, suitable site by exploiting run powder in drilled holes. Dynamite was tried, suitable site by exploiting run powder in drilled holes. Dynamite was tried, suitable site by exploiting run powder in drilled holes. Dynamite was tried, suitable site by exploiting run powder in drilled holes. Dynamite was tried, suitable site by exploiting run powder in drilled holes. Dynamite was tried, service has been built up in Greece, chiefly through the exerctions of Prof. Demetrius Eginitis, director of the National Observatory at Athens. The fifth volume of the annals of this observatory, just published, is a work of some 600 quarto pisses, far the greate part of which is devoted to meteorology. It has published, in Greek, two quiumes of what is planned to be an exhaustrive treatise on the climate of his country. He has also written, in Greak a general work on meseocology (Claxrimy Me. Secondary and the household of the country in the powder on meseocology (Claxrimy Me. Secondary and the powder on meseocology (Claxrimy Me. Secondary and the powder on meseocology (Claxrimy





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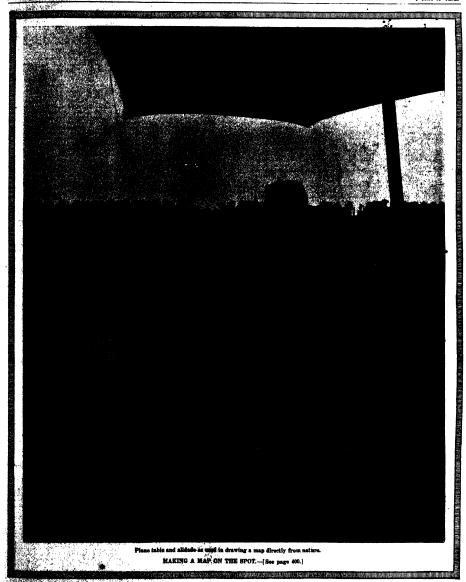


THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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NEW YORK, SATURDAY, APRIL 22, 1911

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The Editor is always gind to receive for examination illustrated articles on subjects of timely interest. If the photographs are shortly interest is the carticles down, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space takes.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fuscination of science.

The Rewards and Penalties of Polar Exploration

N its last saure, our extended contemporary,
The Nary, publishes a map of the North Pole
region, on which is plotted the exact route, as
shown by his note books, along which Peary approached the pole. The map was drawn and
Peary's route plotted by two experts of the United
States Coast and Geodetic Survey, working judependently, and their calculations agree within a seccul of Latitude. Mr. Mitchell, now of the accustic pendiently, at titude. Mr. Mitchell, one of the experts, states that from his professional experience, it would have been impossible for the observations set down in the note book to have been obtained except un-der the circumstances claimed. There was a slight error in Peary's chronometer, which threw him a little to the left of the Pole, which he reached by a detour to the right, that brought him within 1.6 miles of the exact center. The naval committee reports that this very error in the chronometer proves the truth of Peary's position and the correctness of

As the result of this report, our great explorer has As the result of this report, our great explorer has received an altogether too tardy national recognition by being advanced to the grade of Rear Admiral. It is surely a strange anomaly that the attempt to rob Peary of his honors by one of the most atupendous lies of history should have so far succeeded that his own country has given him adequate official recognition, only after the scientific societies of the world had presented him with eighteen medals and honorary degrees, and had agreed, according to the language of the report, according to the language of the report, "in pro-nouncing this the greatest geographical prize of the last three centuries." Elsewhere in the present issue, we publish the map showing Peary's exact position as plotted by the Coast and Geodetic Sur-vey from Peary's note books. It should be observed that to come within a mile and a half of the mathe-matical lude, was a very blook result. As the matical pole was a very close result. As the com-nuttee says, "it is a well recognized fact that exact results are not obtainable as the result of observations. A matter of one or two miles, under favor-

tions. A matter of one or two miles, under tavor-able circumstances, is a far allowance."
So much for the rewards of polar exploration— of the penaltice—physical, mental, and, last and not least, political, the greatest polar explorer of all time has surely more than had his share. There are few conditions that are more exasperating to the are few conditions that are more exasperating to in-professional man than to be baited and hectored by a layman, whose professional knowledge is in the inverse ratio of his seal and volubility. Never did Admiral Peary show finer self-restraint than when he was being subjected to cross-examination before committee by the Hon. Mr. Macon, of Arkansas, committee by the Hon. Mr. Macon, of Arkanasa. Mr. Macon evidently entered the lists against Admiral Peary, armed cap-a-pie. Not alone was he arrayed in all the panoply of longitude, latitude, declination and asimuth, but he could swing right deflity the battle-axe of gravitation and poise with unerrung aum the keen lance of erchritiqual force. Does the gentle reader doubt our statement? Let him read the following question of the honorable gentleman from Arkansas, as launched against Peary in the hearing above mentioned: Mr. Macon: "For the reason that the diminishing

Mr. Macon: "For the reason that the diminishing centrifugal action, and, in proportion, the increasing center of gravity near the pole causes a complete failure of man and saminal energy that produces, a hard of paralysis of the senses and of motion, a paralysis of sensation in any part of the body, including the exercise of the faculty of the mind. Do you know anything about that contention on the part of scientists? . . So that it would be almost impossible for them to excrete their independent functions so that ambody could ascertain a real fact—intelligently ascertain a fact?" Peary answered: "I have never heard of that before."

We have to confess that we have never heard of it

Multiple Engines for Passenger-carrying Aeroplane

In selecting the element of engine reliability as the basis for his handsome offer of \$15,000 for the multiple-motor aeroplane showing the greatest all-round efficiency, Mr. Edwin Gould displayed a discrimination upon which the events of the few weeks have laid strong emphasis. We refer to the fact that the feats of Blériot and Bréguet in carrying respectively nine and eleven passengers have proved that, at least in the domain of sport, trips proved that, at least in the domain of aport, trips in a single acroplane by large parties of people are pretty sure to become a popular form of amusement. When that time arrives, and if we are not mistaken it is coming very quickly, the question of making the aeroplane of large carrying capacity perfectly reliable and safe becomes very important indeed. From the moment an aerial "bas" leaves the ground with its precious load of a dozen or more people, to the moment when it setures to its chosen lastice. the moment when it returns to its chosen landing place, there must be no question whatever of th failure of the motive power; and it seems to us that the only way to gain this assurance is to divide the power between two or more separate and absolutely independent units. It is possible, of course, to assign too much importance to the recent passenger-carry too meen importance to the recent passenger-carry-ing feats in France. I note case, at least, the crowd was made up of boys, and in the other the flight con-sisted of not much more than a short jump at a slight distance above the ground. But the sugges-tion is there; and we may be sure that the promoter, with an eye to gate receipts and profits, will not consider the constant of the constant of the constant of the confail to take note of the money-making possibilities presented by aeroplanes carrying from a dozen to twenty people beset by a crowd of the curious and adventurous, clamoring for the privilege of a ride through the air at anywhere from ten to twenty dol-

At first, these trips will be confined to straightaway or circular flights within the boundaries of smooth and unobstructed aviation grounds or rac-track fields; but it will not be long before the alluring prospects of big profits to the promoter will lead to more ambitious flights across the country.

Now for annotation against according to a seroplanes of magnitude, carrying many passengers, the motive power must necessarily be very large, and its division into two or three units will become a convenience, and for reasons of safety, will become a convenience, and for reasons of safety, an excessity. The considerations which have led to the use of twin-screws on steamships apply with creen greater force to the navigation of the air. The disablement of the steamship motive power may lead to inconvenience; but the breakdown of the sero-plane motor, when the machine is loaded with passengers, might readily mean an appalling extractionly. catastrophy.

The importance, then, of the forthcoming of tition for the Gould prize is evident. Just a aviation is a sport pure and simple. So, in earlier stages was the automobile, which to-day has carier stages was the automobile, which to-day has settled down to its permanent place as one of the most important of our means of everyday transpor-tation. Ultimately, and before very long, the sero-plane, whose development has been far more rapid than that of the automobile, will settle down into its proper place in the economic world. When that condition is reached we believe that the question of condition is reached we believe that the question of the reliability of the motive power will be recognised as absolutely pre-eminent; and one of the most im-portant problems bearing upon reliability will be that of the most effective way of sub-dividing the motive power so as to obtain the maximum efficiency from motors and propellers, both when they are running independently and when they are coupled up for maximum power.

Progress in Motor-driven S

T is greated.

It is recorded that few people in the United States have any laise of the require propers a which is being underly Surpe, in this applies. It is a surper proper of occan going essentialities a regime as the motive power of occan going essentialities. Alteraty is freight stemmer of over 1,000 tons, earrying this type of motive power, is affect and in successful type of motive power, is affect and in successful type of motive power, is affect and in successful type of motive power, is affect and in successful type of motive power, is affect and in successful type of motive power in the successful type of motive powers and the successful type of motive powers and the successful type of motive powers and the successful type of the succes probably be in service.

probably be in service.

The credit for being the first to set afinat a ship of deep-ea, size equipped with internal combustion engines is due to the Dutch, and the "Vailanus," of 1,179 tons gross measurement, will probably be quoted by the historiam as having led the way in this most important field. The "Vaicanus" is driven by a 6-cylinder Dieset reversing engine, which, at 180 revolutions per minute, develops 600 imidicated horse-power. The consumption is stated to be about 3½ tons of crude fuel oil per day when the ship is being driven at fall speed.

Then there is the "Holaspfel-I," a freight steamer capable of carrying about 500 tons of dead weight,

capable of carrying about 500 tons of dead weight, which will shortly be completed by Messrs. Eltingham & Company at South Shields, England. For ham & Company at South Shields, England. For two reasons, particular interest attaches to this craft. In the first place, she will be driven by producer-gas, the plant for which will be placed in a gas-tight compartment entirely separate from the or-gine room, which will contain a 6-eylinder gas en-gine capable of developing 180 brake horse-power at 450 revolutions per minute. The second point of interest is found in the fact that between the or interest is round in the last that between the engine and the propeller will be introduced the Füttinger hydraulic reduction gear, of which so much has been heard in the last year or two. This gray serves at once the purposes of a clutch and a oeed reducer.

A much more important vessel, in point of size, is

the ship recently laid down in Great Britain for the Russian East Asiatic Steamship Company. This vessel, whose tonnage will be 5,000, will be driven fit a speed of 12 knots by two 8-cylinder Dieael oil engines. An interesting feature is the fact that the engines. An interesting feature is the fact that the auxiliary work of lighting, driving the steering gear, and performing other auxiliary duties, will be done by oil engine units of small size.

The most notable internal combustion vessel for

the merchant service is that which is now being built in Germany for the trans-Atlantic service of the Hamburg-American line. This vessel of 9,000 tons riamoure-American line. This vessel of 9,000 tons will be driven by twin engines, each of 1,500 horse-power, and it is expected that she will develop a speed of 11 to 12 knots. The Hamburg-American ship will probably make her malden voyage in the spring of next year, and the ship for the Russian Stromship Company should be in service early in 1018.

It is not often that so bold a step is taken thus early in the process of entirely changing the motive power in any field as important as that of the ocean-going marine engine, and the greatest oredit is due going marine engine, and the greater account of the other was teamable companies above mentioned for the outerprising faith with which they have placed the orders for these two large vessels. Within a year and a half from the present writing, the question of the substitution of the internal combustion for the substitution of the internal combustion for the statement of the greater of the substitution of the internal combustion for the statement of the substitution of the internal combustion for the statement of the substitution of the internal combustion for the substitution of the internal combustion for the substitution of the internal combustion for the substitution of the s of the substitution of the internal communion to the steam engine on occan steamablips of large size will be fairly well settled. Whether the engine builders will by that time by prepared to make such an advance as occurred when Parsons placed the steam turbine in the then unprecedented "Justianian" and "Mauretania," remains to be seen. It is our belief that, regress from 8,000 horser-power to 60,000 or 80,000 horser-power will be made by more gradual increments that accurred in the introduction of the increments than occurred in the introductio

steam turbine.

Meanwhile, we must not forget that both the Meanwhite, we must not forget that some line British and Gorman navies are making experiments on a big scale in the introduction of internal com-bustion motors on warships of large size. Just what the British admiralty is doing we cannot say; but we understand that the Germans are building three we understand that the Germans are building three units of the Direct type, cash of 6,000 horse-power. One of these is to be given a lengthy and severe shop test; and if the results are satisfactory, the three engines are to be installed in a fast cruiser in which the power will be developed on three capraces hafts. If the 18,000 horse-power cruiser proves to be a success, the next step will probably be to a four-shaft vessel of 40,000 horse-power or over.

San a Carlo Maria Maria

G. Stanley Hall

An American Leader in the Science of Human Nature and Its Education

By Edward L. Thorndike, Professor of Educational Psychology in Teachers College, Columbia University

STANLEY HALL has been for nearly twenty La. years the prophet and promoter of the do-trine that human intellect and character can be unad and educated only in the light of their evo lution in the race. He early became fascinated by et that the mind of man has developed from th mind of the lower animals, and that its present makeup and future possibilities depend upon its history for perhaps millions of years past. In season and out of season, to teachers and parents, as well as to his failuw psychologists, he has preached that the history of mental development in the animal kingdom as a whole is the key to the growth of each child's

To this doctrine, which is now accepted as a matan experience which is now accepted as a mat-ter of course by philosophers and theologisms, as well as bislogists and psychologists, he added three others, which captivated the imaginations of many of his

water captavased the inaginations of in-followers. The first is that the growth of a human being's "soul," that is, his intellect and character, from the beginning of life to manhood, parallels or re capitulates the development of intellect and character in the animal kingdom, so that the child's mind is at one stage like that of a worm, at a later stage like that of a fish, later like that of a monkey, later or a man, later like that of a monkey, later like that of a savage, and only after many years like that of modern men. "Stage by stage," he writes, "we enact their lives." "The child and the race are each keys to the other.

The second doctrine is that "Nature is Right" that a child qualit to pass through just this series of stages, that the proits course, uninterfered with by our artificial ideas of what children ought to be and do and become. "Along with the of the immense importance of further co-ordinating childhood and youth with the development of the race has grown the conviction that only here can we hope to find true norm against the tendencies to precocity in home, school, church, and civilization generally, and also to establish criteria by which to diagnose and measure arrest and retardation of the individual and the race."

Since many features of the natural untutored behavior of children, such as grab-bing whatever they want, fighting who-ever tries to take it from them, teasing. bullying, cruelty to animals, laziness and envy, are intrinsically detestable and so seem to prove that nature is abominably wrong. President Hall devised the third doctrine, that certain childish tendencie which, in and of themselves, would be pernicious, are, nevertheless, desirable, because only by their exercise in childhood can one avoid a worse fate later That is, by having cruelty in a mild form

at six, one is preventively inoculated against being 9 By being a bully in childhood one Nero at aixty deployable tendency of adult financiers would have en driven out of their systems, had they been left free in the nursery to take whatever they wished, and the in the nursey to take whatever they stated, but blte, soratch, or otherwise inflict upon protesting playmates whatever the market would bear!

These three doctrines are, of course, somewhat misrepresented in so brief and baid a statement.

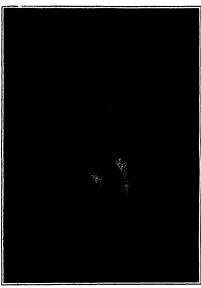
Full quotations from Prosident Hall's writings would show them in a more tempered form with compa mises toward the opposite doctrines—that a child's mind is made into an adult's mind in the east that nature has hit upon; that the original nature of man is very wrong in spots, and that indulging a bad tendency in childhood helps to form the bad d and all.

Partly in the interest of these theories and partly from a pure scientific curtosity, President Hall a his popule at Clark University have turned from the usury roppes of mental science—from questions about pew iman, perciarys, how he remembers, how he rea-systs, "reliat himsphosthen is, what attention involves, and this libs- to questions of what outcreas, particular acts, said this particular press situations which lits offers. He has greatly again the pression of the control of the less great as the post how children think and seel and

act toward water, trees, clouds, money, games, hon e, teacher, society, solitude, has amassed long lists of what situations call forth the responses of fear, pity, anger, and the like. He has canvassed history, biography and literature for evidence about what concrete human nature really is and how it behaves

Thousands of printed questions have been sent out broadcast —a modern inquisition ranging from "What effect has a new overcoat, high hat, high heels . . . upon the self confidence, self assertiveness and per-sonality of the owner?" to "What force and motive led you to seek a higher and a better life?" and from What do you know of beggars?" to "Have lib ing theological opinions made you better or worse.

It is now generally admitted that the difficulties



G. STANLEY HALL

human nature are well nigh insurmountable, and that the practice of issuing these so-called Questi without elaborate cross-examination and objective verification is undesirable. But for the fundamental motive that prompted them, the desire to make psychology a science as broad as human nature itself, there can be only praise. President Hall was an early leader in making phychology the science of total human nature, and in showing what work it had to do in explaining the actual behavior of men in work, play, health, disease, crime, religion, and every

Granville Stanley Hall was born at Ashfield, Mass chusetts, sixty-five years ago, was educated at Williams College, Union Theological Seminary, Harvard, and abroad. He was one of the eminent group com-posing the faculty of Johns Hopkins University. In 1829 he organized Clark University, of which he has since then been president

President Hall's writings, published in the main in the American Journal of Psychology and Pedagogical Semisary, make a very long list, over two hundred, comprising perhaps five thousand pages. He is the editor of the Journal of Religious Psychology and the Journal of Race Development. He 's now putting together the results of a life of enormous activity in collecting facts about human nature and behavior in the three final worksone on psychology in general, one on Adolescence and its Relations to Physiology, Anthropology, Sociology, Sex, Crime, Religion and Education, and one on Educational Theory and Practice. Of these the second was published in The volume on Educational Problems has recently

A large work of his on the Psychology of Feelings is approaching completion. He also has in hand books to be entitled "The Psychology of Jesus and of Religion Generally" and "Genetic Psychology."

The Jumping Bean

THAT extraordinary product of the vegetable kingdom, the "jumping bean," is derived from a bush, closely resembling the coffee bush, that ;rows in the River country of western and northern Mexico. The bush attains a height of from

three to four feet, and the hundreds of blossoms that it puts forth are of an olive-green tint which, after ripening, turns to a buff gray. Within each blossom are two "fertile" seeds, and a third, which is the home of a small, exceedingly active worm, whose performances are responsible for the queer conduct of the bean. When this worm emerges from its prison it becomes a beautifully colored moth.

The seeds of the jumping bean blo in the month of May. Then the female moth deposits one egg on the pollen of the As the flower develops it forms a triangular-shaped shell on two sides, with a convex shape on the other. Within this the chrysalis develops into a graylab-brown worm about one-tenth of an inch in diameter and about half an inch in length his worm lives inside its cell for a period of six months, or until the middle of Noof six months, or until the induce of No-vember. Then, climatic conditions being favorable, it bores a hole through the end of its shell and files away as a moth, to mate in its turn and perpetuate the

If, however, it is brought in the bean to a colder climate the worm will die in the shell Cut a small hole in the end of a jumping been about an eight of an inch in diameter, and in less than one hour worm will cover the break with a white fiber-like exudation from its stomach, working the mouth round the opening until the hole in the shell shall becom completely closed

Kept in a moderately warm place, and not packed too tightly, the jumping beans will live for five or six months to mystify and amuse. The jumping is caused by the worm's curling itself into a ball and then springing out to full length against side of the shell, thus making the bean jump from the hand into the air.

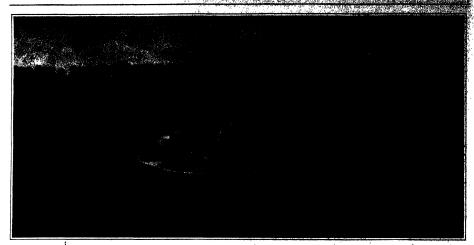
Journalistic Colors

With the use of colored paper by American journals is usually confined to the magazine and sporting supplements, in other countries, particularly England, colored paper seems to be a kind of journalistic mark There is the Westminister Gazette, which, by reason of the color of its pages, has been called "the sea-green incorruptible." The old-fashioned Tory organ, the Globe, offers a deep pink, as does it contemporary, the Sporting Times, with greater reason. The Winning Post shows a nice, pale orange.

The stock of paper in the island of Trinidad becoming exhausted, the Port of Spain Gazette for a time appeared on a manye colored paper, together with a bright yellow inside supplement. showed for several issues cerise paper, with a magenta

A journal published at the Cape of Good Hope once A journal published at the cape or took trope once found itself obliged to employ a kind of brown paper, the sort generally used for parcels, and two succes-sive issues of a native journal at Ahmedahad were printed respectively on a brilliant yellow and a dark

green paper
In 1907 the Chung Ngoi San Po marked the occasion of its "jubilee" by appearing on scarlet paper,



F ROM the tops of the highest mountain peaks to the depths of the most fever ridden swamps, from the regions of snow and ice and cold, so great that stoves must be used to thaw out stiff fingers be tween every focusing of the alidade, to the regions of such heat and humidity that only mosquitoes and other insect pests prevent the men from working half naked, they go, these map makers, and not one man hundred who consults chart or atlas realizes what they do or how they do it; only this he knows that the result is to be relied upon, and that ship captain or commander of an army may put his faith for the safety of the lives in his charge in the ac-curacy of the maps furnished him by the government.

Map making and chart making have both many ramifications The Coast and Geodetic Survey does not only the triangulation work along the coasts, the hydrographic work for depth of water, but the plane table work, the actual outlining of the coast line, from nature herself. The Geological Survey does similar work inland; the Hydrographic Office concerns itself with water map making. Of these several departments, the most picturesque and by no means the least important, is the plane table work, since it is from this work that the charts themselves

A plane table is exactly what its name implies— a table which can be made plane with the sea level

With it are used a few simple appliances, and with no other means than these, and the triangulation work which has been done before, the maps and charts of our huge coast line, our harbors, our rivers and our lakes, are made.

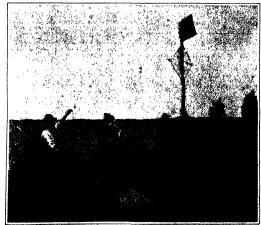
When a plane table party goes to work they have what is known as the "sheet," a piece of carefully prepared parer, made so as to shrink and expand as little as possible, on which are marked a few dots, indicating the position of certain triangulation points in a certain part of the country. The first thing the party has to do is to select one of these points on the lank and erect the table directly over it. The table is, git wood, fastened to, a "movement," which is, supported by a heavy tripod. The plumb bob underneath must point to the signal point on the land. On top of the table, the sheet is unrolled and elipped down, so that the point on the sheet which represents the point on the sheet which represents the point on the land, is accessible. Then the alidade is brought into play. This is a small telescope which swings only in a vertical are and which is for a base a long, thin steel strip, the sides of which are parallel with the line of sight of the telescope. Within the eyeplece of the telescope are cross hairs, which bear a fixed relation to the di-

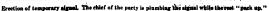
visions painted on a rod, known as a telemeter rod.

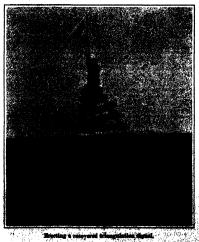
The alidade is set upon the sheet, one edge of the base touching the point on the paper indicating the signal over which the "station" is ere of the alidade is also made to touch another triangulation point. The table, previously made level, is now swung around until that other triangulation point, in nature, is visible in the telescope. The table is thus oriented—made so that the sheet is true

A rodman, with the telemeter rod, is then sent out, to stop at the first bend in the coast line. The ob-server swings the alidade until he can see the rod, server swhaps the alldade until he can see the rod, keeping one sdage of it always on the signal point on the paper. Looking through the telescope, he "reads the rod" for the distance, in metale. These, with com-pared to the distance in metale. The "first the rodman is placed, the straight adge, of gourse, giv-ing him the direction. The rodman then individue to the ment bend in the coast line, and the process is re-peated, only the time the end of the first mark and the second position of the rodman are joined with the result. How sutting on more the exact coulding a

the second position of the rodman are joined with the peand; thus putting on paper the exact outline of the coast, measured on the spot, from nature. The charts are usually made on a cacle of 1:19000. Rodmen are worked in pairs, one going ahead, while the other is being "read," and this process is continued until the divisions on the rode can no locate by read through the likeled. Thus the thickness. ionger be read through the alidade. Then the whole "station" is moved, and the plane table set up over







Brecting a recovered tel

the most consisted by the test rotimes. The table is supposed upon all the triangulation-signate in sight, and the triangulation-signate in sight, the test the party out of sight of all the visit edgests, in which case a comporary signal must be set; upon the land, plumb, straight and true, and criefsed upon the signals in sight, and its position found upon the paper by a dainty surveying activation known as the three-point problem, in which the observer finds his position within a circle frogs three known points entate that circle

Warking cut this three-point problem is usually deas by a sort of trial and error system. If the chief the party knows his business and must erect a signal sonsewhere which is not upon his chart, he can usually make a pretty accurate guess as to where to put his pend; on his chart to indicate the spot where his signal will be exceted. With this for a beginning, he orients his table on a visible signal and checks it up with other signals. As he has only guessed at the position of the new signal the lines from the other signals, as drawn upon the chart, form a triangle, known as the "triangle of error," somewhere within which the true point of the new signal will be located. By the spape of this triangle, the chief can

or working through some woods, where all signal are for a time, out of sight. In such a case, the rod-man, himself, becomes a signal, and the "station," when sretced, is oriented on the other rodman over the position of the "station" just left. Two miles can be "traversed" in this way with reasonable scane, although, as soon as a signal comes in sight excurse, although, as soon as a signal comes in sight again, it is necessary to "check up" on it, and get rid of any error which may have been made.

Plane table work is thus seen to be not especially difficult in its essentials. But it requires care, good difficult in its essentials. But it requires care, good of a high order. The work cannot be processed in the processed of a high order. The work cannot be proceeded in rain or snow, because of the damage the elements would do to the "sheet," but other natural factors make the work difficult at times in certain localists, the mosquitoes are so thick as to make plane had be work a torture. The observer must have both hands and his eyes free to manage the instrument. The roduce must plod through thicket, high grass, awamps and underbrush, when the station is to be moved, every one is so loaded with instruments that there is no chance to fight these peats. It is not not uncommon to come on a party doing this work, particularly in Alaska, in summer, with faces and hands

hyer, an' we reckoned yo' all ruther we got yo' all's flags than yo' all get th' 'pits'"

There want's man in the party who had been vacchasted for ten years. Their work took them within a few feet of the pest hobse. And there wasn't a man in the party but went quietly and calmly about his work, or even hurried it Luckly for them, no one sot "th" pits," but the danger and the courage were there, none the less

It is not unusual for a party to find a triangulation signal—a huge structure of boards and timbers—destroyed or carried away, either by the elements, or by the matives, for firewood. When this happens the signal must be rebuilt! If enough of it is left to mark the spot, all that is necessary is lumber, harmers, axes, and some skill. But if it is all goon, the "ground mark" must be sength for. The ground mark is a pag, driven deep into the ground, with the true "point" marked on it. If thus is gone, there is another, either a bottle or jar, marked with the true point and buried three feet on more in the earth. Its approximate position must be determined from signs of the old signal, or, if necessary, by working out a "three-point" problem, and then it must be hunted for until found. When recovered, a new signal must be



Running a traverse line with the plane table and alidade

HOW THE PLANE TABLE IS USED

tell approximately where the true point is He marks it, and proceeds as before, getting the second time also a triangle of error, but a much smaller one. Successive trials reduce the size of this triangle of error until the exact true point is determined, when the new signal on the land, and its determined position on the chart, become just as effective for further work as a trianguistion signal. These temporary plans table signals, however, are only erected for work around corners and up rivers and small in-lets, or for traverse work.

Traverse work is required in plane table work for count charts by the necessity of having something most tip the property of having something may upon the chart time the mere coast line. Ship redde near it, the small towns, woods, etc., if only as useful information in case of a wronk, all soldings, of course, visual determination of a shire specified as the second of the coast published as the second of the coast planity should be shall be

one mass of raw, bleeding and swollen flesh. But you will never hear a complaint, so long as the "work" is progressing fast enough

"work" is progressing fast enough Much of the work of gettinx from the station at the end of one day's work, to camp, and getting back the next day, is done with launches. The weather these little boats are forced to endure, and the hazardous landings made in a tender, will make even a waterman wonder, but a plane table party thinks of little beside the importance of the work it is dofug; storms, dangerous boating, fever, mosquitoes, even small pox will not frighten them away. There is record of a party which came to survey a small island in a southern bay, and which immediately went to investigate the red and white fags that should have flown from the triangulation signals, but were seen bring from a dead tree near a small cabin. A south ern "eracker" came from the house and watched them,

oracase caste from the nouse and watched them, incuriously, as they approached.

"Why have you taken our flags!" the chief of the party demanded. "Thon't you know it's a penal offence to tamper with 'the property of the United States?"

"Ya-as, suh!" came the unexpected answer. "I knows it. But we all got fo' cases of small pox in built, from number, obtainable locally, from trees cut and trimmed on the spot, or from supplies hauled a long distance away—but the signal must always be rebuilt

Plane table parties must have for members men who are at once engineers, surveyors, builders, watermen, woodsmen, and inventors. Every possible condition of outdoor living must be met and conquered, every possible difficulty overcome, and through it all, and with it all, the work must proceed. On the accuracy of the work will depend the safety of millions of property, untold numbers of human lives. Imbued with this idea, be the difficulties what they may, the plane table parties of our government press steadily onward, manping and remapping the coasts of our waterways and our ocean front. A work never to be finished, since coast and waterway lines change constantly, a work indispensable to our welfare as a nation. So that, little known though they may direct from nature. These plane table parties play an important role in the progress of our civilization, and deserve more recognition and honor than has littlerto been accorded to them.

The Total Solar Eclipse of 1911

The Moon's Shadow Traces a Course from Australia to Central America

By Frederic R. Honey, Trinity College

 $T^{
m HE}$ total eclipse of the Sun, which occurs on April 28th of this year, will be observed under somewhat unusual and interesting conditions. The principal value of a total solar eclipse is obviously dependent upon the possibility of observing the phenomenon from a land area to which it is possible to transport the instruments for observation. In the

event of totality occurring in midocean, or in the inaccessible polar regions, the as-tronomer is deprived of whatever value might accrue to science. But on April 28th an interesting aspect is presented, notwith-standing the fact that totality occurs in midocean, inasmuch as the waters thus visited contain the land areas of the Samoan and Union islands, and the Tonga or Friendly Thus is afforded an opportunity for scientific expeditions to these regions, which, though geographically remote, and in some cases must be reached in surf boats, are in no wise discouraging to the enthusiastic observers who will visit them for the purof observing the wonderful coron the Sun. The significance and value of the eclipse phenomena may be judged by the personnel of the several expeditions which are already equipped and on their way to these islands of the equatorial Pacific scekers for more light on the science of solar physics are traversing the long distances from such observatory centers as Stonyhurst and South Kensington, England; Sydney, Australia; Lick of California and others, for the knowledge which may be obtained in two to four minutes' view of totality; and even these few precious moments of observation are entirely dependent upon fair weather With all conditions favorable, the patience of the astronomer who has "pursued the shadow" will be rewarded by the wonderful aureole of light which sur-

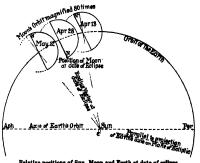
The drawings which illustrate this article are designed to show graphically the rela-tive positions of the Sun, the Earth, and the Moon, at the time of the eclipse.

An eclipse cycle of eighteen years and eleven and one-third days—or a Saros (which means repetition) includes on the average seventy eclipses, of which forty-one are solar, and twenty-nine are lunar. period from 1893 to 1910 included forty-two solar and twenty-seven lunar eclipses; and a sour and twenty-seven lunar eclipses; and a lunar appulse occurred twice—an average of about four eclipses a year. This year is an excellent illustration of the Saros. Each of the last three eighteen-year periods has included three years during which no lunar eclipse has occurred. The years 1857, 1875, 1893 and 1911 contain no lunar eclipses A total eclipse of the Sun occured on March 25th, 1857; on April 5th, 1875, on April 16th, 1893, and it will be repeated on April 28th, An annular eclipse occurred on September 17th, 1857, on September 29th, 1875, on October 9th, 1893, and it will be reneated on October 21st, 1911

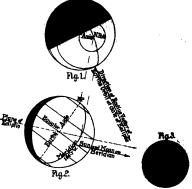
The reason why there will be no lunar eclipse during April or May of the present year will be apparent on an inspection of the plots of the orbits of the Earth and The latter is magnified eighty times in order to show more clearly the position the Moon relative to the node; and it will be noted that in magnifying the orbit, the angle between the radius vector of the Earth's orbit and the line of nodes of the Moon's orbit is preserved. On April 18th, fifteen days before the eclipse of the Sun, when the Moon will be above the plane of the ecliptic and approaching the descending node N', and the radius vector of the Moon's orbit will be projected in the radius vector of the Earth's orbit produced, the Moon will

be near the node, but not near enough to the plane of the ecliptic to come within the Earth's shadow on May 12th, fifteen days after the eclipse when the Moon will be below the ecliptic, and the radius vector of the Moon's orbit will again be projected in the prolongation of the radius vector of the Earth's orbit, the Moon will be too far away from the plane of the

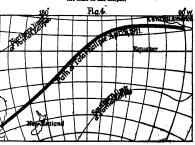
ecliptic to come within the Earth's shadow. The plot shows the position of the Moon relative to the ascending node N at the time when the projection of the radius vector of the Moon's orbit will coincide with that of the earth. The moon will be very near the node and below the ecliptic; but if it were a little



Relative positions of Sun, Moon and Earth at date of ec



Position of the Earth and apparent diameters the time of the eclipse. ers of the Sun and Moun at



farther from the node, the Moon's shadow would be projected wholly on the southern hemisphere. Fig. 1 is the projection of the Earth on the plane of the celiptic, and Fig. 2 its projection on a plane which he parallel to its axis and pe erpondicular to the plane of the ecliptic. The equator, the tropics, the gift cles, and that meridian which passes through

point from which the central college will be wighte at moon, are shown in both projections. The point from moon, are snown in outs projections. The points reason which the central eclipse will be visible at noon will be very near the equator (lat. 0.6 deg. S.; fong. 184.7 deg. W.), and will be below the plane of this equiptic corresponding to the situation shown in the high of

the Earth's orbit. The Sun will be tetally eclipsed, and this proportion between the apparent diameters of the Sun and Mosta at apparent diameters of the south and moon as the time of the solippe is shown in Figs.5. At each successive flares the Moon's shadow is projected on a different part of the Earth's surface farther west. Tols. is on account of the additional fraction of one-third of a day during which the Earth rotates into a new position. But during the interval of fifty-four years and thirty-four days (March 25th, 1857, to April 28th, 1911) or three times eighteen years and eleven and one-third days, the Earth will have made a number of rotations which will result in the Moon's shadow being prowill result in the Moon's shadow being projected on very nearly the same part of the Earth's surface. The date of the total colipse in 187 was March 86th 19.41b. That of 1911 will be April 36th, 10.27b. within a fraction of an hour of three times the length of an eclipse period.

Fig. 4 shows the path of the total eclipse which acteed from Australia across the

equator to Central America. As a partial eclipse it will be visible in the eastern part of Australia and New Guines, and will include Van Dieman's Land, New Zealand, and the islands to the north. It will be visible in the United States, Mexico, and Central America. Washington will be very near the limit of visibility, where a small near the limit of visibility, where a small partial eclipse will be seen, the Sun setting

A Novel Method of Obtaining Pure Oxygen

THE chemical laboratory of the National Bureau of Standards recently had need of a large quantity of practically pure oxygen gas in carrying out certa This gas was propaged in one of the physi-cal laboratories of that institution by the electrolysis of water. The positive elecwas suspended in an ordinary round trode was suspended in an ordinary rouna quart bottle with its botten removed. This bottle was provided with a hollow metal stopper which formed part of the electrical connection between the positive electrode and the outside main. The elec-trolytic apparatus was pinced outside the building, and as the hydrogen given off at the negative pole was not needed, it was allowed to go to waste.

The oxygen gas escaping through the hollow stopper under a pressure of only a few inches of water was conducted through a long copper tube to a purifier containing platinised quartz. Although this purifier was used constantly no impurities were found in the gas. From the purifier the gas was conducted through a valve-head to a two-liter cylinder of heavy brass liued with nickel. This cylinder was suspended in a bath of liquid air at atmospheric Fresh made liquid air boils at sbout 9 deg. C., lower temperature than exygen, and this difference was sufficient to cause the oxygen to liquely. When the cause the oxygen to liquely. When the brass cylinder was filled with liquid supstan, the current was shut off from the
electrolytic apparatus, a countous issel dash
was connected up with the witer had, the
liquid air bath penneyed, and the tigrid
oxystan at once began to vaporise swings to
the heat received from the surrounding
atmosphere. When the gage on the relihead indicated sufficient pressure the electric state of the
head indicated sufficient pressure the electric state
of the property of the columns of the filled
flow per count pure. It will be now that county inflowed in this copy is as men chieffers perfor as in
flow and the complete process. Solvents are sensitive to
solutions with the liquid air postfilled pressure.

Correspondence

cial Rates and American Shipping To the Believe of the SCIENTIFIC AMERICAN:

"I blink; your mignetion sk to twering duties on goods imported by American ships the proper solution" of a vesting problem. What the people object to be the judgment of money directly out of the Treasury to perjame shipowners. The lowering of the duty on corpiose imported by American ships would remove this chiection, while the lowered duty might lead to dection, while the investment lessen the reven w. R. Smith. of the government. Woodbury, Tenn.

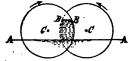
A Perpetual Metion Device

We have received from Mr. Thomas Childs an in-teresting communication in which he describes a "perpetual motion machine" presenting some appar-ently users features. Our readers may find it interesting to search out the fallacy of this ingenious de We therefore reproduce below the main gist of Mr. Childs's letter:

To the Editor of the SCIENTIFIC AMERICAN:

The accompanying sketch illustrates a device which should apparently furnish a continuous and perpetual

In the diagram the line AA represents the level of in the dragram rue line A represents the level of water in some suitable container in which the apparettus for some suitable container in which the apparettus consists simply of two or more disks arranged to readily rotate about their axes at 0°C, as shown, the overlapping portions of the disks being placed close to one another the water rises between them to the level BB by capillary action. The effect of the weight of the wate



Cantilary perpetual motion machine

and supported on one side of each thus drawn disk, should be, it seems, to make both wheels turn in the direction indicated by arrow heads. Sumter, S. C. TROMAS CHILDS

Fire Drills in Factories

To the Editor of the SCIENTIFIC AMERICAN: Your editorial on the subject of "Fire Drills in Facin the April 8th issue, is a strong argument for legislative action upon something that is certainly ded as much in industrial establishments as in schools, if not more so, on account of the entirely different conditions to be found in factory and school buildings; but it will perhaps be a difficult matter to enforce the observance of a law making fire drills compulsory, if the duty of conducting drills devolves upon factory owners. The average factory owner or super-intendent of a factory similar in character to the one intendent of a factory similar in character to the one in which the recent terrible loss of life occurred in New York, is usually too busily engaged in keeping his work poole "speeded up", to give attention to what he would probably term "a waste of time" And where is the man, or woman for that matter, in a manufacturing or mercantile establishment of any demandation. scription who will admit the possibility of fire origin-ating within their own premises? I have failed to ating within their own premises? I have failed to did one during many years of experience in visiting factories. "We have been in business for forty years and sever had a fire." is heard quite often in fac-tories. Most school buildings are provided with am-ple means of exti; deskt and chairs are fastened to the floors in regular rows with alies between; there are no piles at light infammable material heaped up ded over large areas, to come in contact with or suspended over rarge areas, to come in constant visit fighted has gets; the pupils, as a rule, do not smoke classrettes in the buildings, as do ninety-nine per cent of the mule complifies in the various branches of the distilling industry; there are no motions to spark, no of the male couplifies he the various branches of the citedrage functor; there are no meters to spark, no chieft bearings to run hot, no oily regs or waste ma-térigia to accommista, nor any greating-toile study to accommistate, nor any greating-toile study of the supported with gas deposity leaky rubber tobing. All of these and other humands state in a shirtwester or distilling factory, and the overlage machines are usually placed acloss topother or long tubies, between which was the share, work knows, etc., of the oppositoria; and have consensated years chair said hore bacemen an ob-lation of foreign seventage nor, the lately servined in-placed in the acutive passenge. It is not only the placed of foreign seventage nor, the lately servined in-stances that, will become memorivables in the pocu-cions made as the sace yes have redered in, for an one

is panic proof when his escape from fire is cut off, and there is no arrangement of fire escapes applicable to a tenestory building that will serve the needs of several hundred people endangered by smoke and The building of moderate height is no en tion to the rule, for many persons have been com-

pelled to jump from second-story windows.

But you have sounded the keynote of this most important theme in your suggestion that "it should be made compulsory for the landlord or lessee to install an effective system of automatic sprinklers And it is of daily occurrence that efficient systems of sprinklers either put out fires in their inciplency, or so hold them in check as to give people a reasonable time to escape, and the fires are practically ex-tinguished when the firemen arrive. We do not often read of these occurrences in the daily press for they are not advertised—it being only when fire gets beyond control and lives are lost that at-tention is paid to such matters; but records are kept by those interested in sprinklered risk fires, which can easily be procured from the National Fire Protection Association, 87 Milk Street, Boston,

In some cities sprinklers are required by law in theaters, in the basements of large mercantile buildings and in basements of school buildings, for that where school fires usually start, either from defective heating appliances or from bad housekeeping Why should the far more hazardous factory build-

exempt from such a law? Sprinklers are not new; the cost of installation is not exorbitant, nor is the business monopolized by a corporation The sprinkler equipment is a profitable investment; not only through reduced cost of insurance, but when is considered that serious loss by interruption to business is prevented by a very simple device, which merely requires the maintenance of a few thousand gailons of water. Modern buildings will prevent the spread of fire beyond certain limits; but the contents need as efficient protection as in the ordinary frame structure, and the automatic sprinkler is the only known device for such service.

Philadelphia, Pa.

The Planetary Gear Problem In our issue of February 18th, 1911, Mr. Joseph de Martino suggested to our readers a mechanical prob-lem. It was required to find the number of revolutions of the central gear wheel for one revolution of the satellite when the peripheral (internal) gear was held fixed, and vice versa. We have received a large number of communications giving solutions by various methods Most of the answers to the problem were correct. A number, however, were short of the true answer by just one revolution. Thus, one cor-respondent says: "Gear C will make as many revo-lutions as the number of teeth in gear C is contained in the number of teeth in gear A" He thus obtains for his solution of the first problem.

 $2\xi f$, 4, 6 ξ . We have selected from the many solutions sent in two which seem to commend themselves for their lucidity and briefness. These are reproduced below To the Editor of the SCIENTIFIC AMERICAN:

I offer the following solution of the problems of Joseph de Martino on page 162 of your issue of the SCENATURE AMERICAN of February 18th:

Let Do the circumference of the circle described by the hub of circle B, and let d be the radius of this

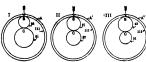


Diagram of me chanical problem

circle, and b and c the radii of wheels B and C reenectively

Then 6 = b + c in all the six cases

 $2 \pi 6 = 2 \pi (b+c) = 2 \pi b + 2 \pi c$. Therefore the circumference of D equals the sum of the circumferences of B and C. Let us use one cog as the unit

Then $D_1 = 96$; $D_{21} = 74$; $D_{121} = 66$. Now a point on a rolling wheel diametrically op-osite the petat of contact moves twice as far as the hub. The power wheel always engages this opposite point. So is gaint on the power wheel will move twice as far as the hub of B, i. e., a distance equal to

So this distance, 2.D. divided by the circumference of the power wheel, will give the number of revolu-tions the power wheel makes.

The solution of the first problem is therefore

$$\begin{array}{cccc} \frac{2D_{\rm I}}{61} & = \frac{172}{61} = \frac{250}{61} \\ \frac{2D_{\rm II}}{87} & = \frac{148}{87} = 4 \\ \frac{2D_{\rm III}}{21} & = \frac{132}{21} = 6\frac{2}{7} \end{array}$$

When the central wheel is fixed, the number of revolutions of the internal gear is similarly obtained by dividing the total travel, expressed in number of teeth, by the number of teeth on the internal gear

$$\begin{split} \frac{2D_1}{111} &= \frac{172}{111} = 1\frac{61}{111} \\ \frac{2D_{11}}{111} &= \frac{16}{111} = 1\frac{1}{3} \\ \frac{2D_{11}}{111} &= \frac{182}{111} = 1\frac{7}{37} \\ &= \frac{7}{111} = 1\frac{7}{37} \end{split}$$

To the Editor of the SCIENTIFIC AMERICAN In answer to Mr de Martino's problem, 1 offer the following solutions.

 1_{111}^{11} ; $1_{\frac{1}{2}}$; $1_{\frac{1}{2}}$.

The simplest method of arriving at these results seems to me to be as follows (1) Suppose that the plate carrying the satellite gear B is stationary Then (supposing that the three gears A, B, C have a, b, c teeth respectively) it is easy to see that A and C will revolve in opposite directions at c, a revolutions per minute respectively. We may represent this thus:

$$B \dots C \longleftarrow (a)$$

(2) To find out what happens when A is held sta-tionary, conceive that the whole system revolves at the rate of c revolutions per minute to the left. Then the diagram becomes

$$\begin{array}{cccc}
A & & \\
B & \leftarrow & \cdot & (c) \\
C & \leftarrow & \cdot & (a + c) \\
\hline
\text{skes} & onc & revolution. C & makes
\end{array}$$

Hence when B makes one

$$\frac{\sigma + c}{c}$$
 revolutions.

(3) When C is to be held stationary, conceive that the system represented in (1) revolves as a whole to the right at the rate of a revolutions per minute Then the diagram becomes

$$\begin{array}{ccc}
A & \longrightarrow & (a+c) \\
B & \longrightarrow & (a)
\end{array}$$

Hence when B makes one revolution, A makes

$$\frac{a+c}{a}$$
 revolutions The particular cases given can

now be worked out. IMMO S ALLEN. London, England

The Current Supplement

THE opening article of the current Supplement, No 1842, is devoted to a very thorough review of to love, is devoted to a very thorough review or the English Aero and Motor Exposition at Olympia, London.—Mr Walter V. Turner's article on "The Air Brake as Related to Progress in Locomotion." is continued.—Some formule for frosting, otching and coloring incandescent lamps are given —The Paris correspondent of the Scientific American reviews the recent work done by Capt Ferrié in wireless teleg-raphy from airships.—George C Rice, Chief Engineer of the Bureau of Mines, contributes an article on the plan and purpose of the experimental coal mine which the United States Bureau of Mines has estab-lished at Bruccton, Pa--Mr F Alex McDermott writes instructively on the chemistry of biophotogenesis, which, in its complete sense, is the production of light by living organisms - The camphor in-dustry is described -- Over twenty-five years have passed since Wilhelm Roux published his first tribution to the mechanics of evolution, in which he indicated an effective method of analyzing the complex processes by which an individual organism is developed. Since his time much progress has been made, progress which is reviewed in an article entitled "A Quarter of a Century of Experimental Embryology "-"Road Making in the United States" gives the present status of the use of bituminous materials.

—"Psychanalysis" is a new word, which, in terms comprehensible to the layman, has been defined as the science of reading the inmost secrets of the heart and soul in spite of—sometimes without the least sus-picion on the part of—the person who is the subject of The progress that has been made is

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

"Investigating" Peary

THE trials and tribulations of Robert E. Peary in obtaining recognition for his remarkable polar plorations are fully recorded in Congressional records. Our contemporary, The Naty, has performed the com-mendable task of lifting out of their obscurity these interesting documents, which should be placed before every American reader, so that he may know why it ert E. Peary has been made a rear admiral, and why European scientists, in particular, have so instintingly accorded that full meed of praise w he so richly deserved. From The Navy we call the following interesting particulars:

The Committee on Naval Affairs made an extended report wherein it was stated: "Robert E. Peary reached the North Pole on April 6th, 1909. From a camp, which he established at a point estimated by observation at 89 deg 55 min, north latitude on said date (slightly over four miles from the exact pole). e two excursions on that and the following day, which carried him close to and beyond the

Capt. Peary appeared in person before the com his papers, original data, the daily fournal kept by

him during the journey, and notes of astro nomical observations and soundings, etc. The committee had before it the report of the Na tional Geographical Society of Washington and a report from the president and one of the board of governors of the Royal Geographical Society of London. An independent examina-tion of the data and proofs was made and a report was submitted to the committee by Hugh C. Mitchell and C R. Duvall, expert computers of astronomical observations of the Coast and detic Survey of the United States Mitchell and Duvall came to the conclusion that Mitchell and Duvan came to the concussion tools. Peary passed within a little over a mile of the exact pole, and that the march of April 7th, 1909, may have carried Peary even within a stone's throw of that point.

"The hearings established the fact that Peary reached the North Pole on the above-named in pursuance of a well-defined and fully laid plan, which he had been able to formulate as the result of more than twenty years' Arctic experience, and which he was able to carry out be ecause of an indefatigable earnestness and singleness of purpose.

estness and singleness or purpose.

"As a result of this plan, when he reached out over the Arctic Sea, as had been done by other explorers—Nansen, Greely, Lockwood, Markham, and others—and came to a point

beyond where they had turned back, and beyond where he himself in former excursions had obliged to retreat, he was able, by reason of his sup porting parties, to go forward with sledges filed with provisions and fresh dogs for locomotion, these very essentials of success having been conserved for his final dash.

Three years before, in 1906, Peary had r 87 deg. 6 min. N., the farthest north ever attained up to that time He then learned the necessity of mor careful preparation, and, returning to the United ned a campaign by ship, men, Eskimos, dogs, canned provisions, lighter equipment to the very

last detail, which resulted in success.

"Peary was an officer of the United States navy, and charged with the specific duty in which he was en-gaged. President Roosevelt, July 3rd, 1908, detailed Peary to report to the Superintendent of the United States Coast and Geodetic Survey, and instructed that Peary be ordered to make tidal observations along the Grant Lan1 and Greenland shore of the Polar

As to the accuracy of Peary's computations, the

committee states among other things:
"Mr. Mitchell and Mr Duvall figured the position of Peary at the pole independently, but based on the same observations and by independent methods. Their calculations agree within a second of latitude.

"Mitchell states that from his professional experience it would have been impossible for the data of e observations to have been obtained other than under the circumstances claimed. The observations at the pole were made at different times. He states that in using those observations in connection with the case of the property of the case o

been made at the points set forth in the data." As to the matter of an error in his chromometer, which has been used as the basis of certain attacks upon Peary's claim that he reached the pole, the committee has to say:

"This very error proves the truth of his position and the correctness of his observations, based upon his own chronometer. Had his chronometer been exactly correct, Camp Jesup would have been in direct line with the pole, as he had supposed from his own observations, and the forward march would have brought him exactly over its location. His detour to the right, however, on the following day brought him within 16 miles of the exact center, which is substantially the goal he sought."

The committee comments further as follows:
"It is a well-recognised fact that exact result not attainable as a result of observations. A matter of one or two miles under favorable circumstance a fair allowance. Dr. Nathaniel Bowditch, in the

American Practical Navigator, an official publication of the United States Navy Department, states: In obtaining results of observations it is impossible to make an exact allowance for error in chronometer

sextant and error of refraction and of observation No navigator should ever assume that his position is

From The Navy.

Positions plotted from observations made by R. E. Peary in the vicinity of the North Pole.

not liable to be in error to some extent, the precise ? amount depending on various factors, such as the age of the chronometer rate, the quality of the various instruments, the reliability of the observer, and the conditions at the time the sight was taken. a fair allowance for this possible error under favor able circumstances will be two miles; therefore instead of plotting a position upon the chart and proceeding with absolute confidence in the belief that the ship's position is on the exact point, one may describe, around the point as a center, a circle whose radius is two miles (if we accept that as the value of the possible error) and shape the future courses with the knowledge that the ship's position may be any-where within the circle."

Polar discovery has always been recognized by the country to whom the explorer belonged. Shackleton. who reached a point within a hundred miles of the who reached a point which a numered mass of the South Pole in 1909, was granted 230,000 by the British government and knighted by the King. William E. Parry, in 1827, reached 82 deg, 45 min. (the record of the farthest north), and was knighted by the King. Sir John Franklin, for explorations of the Arctic coast, was knighted, as were also John Ross in 1835, James Ross in 1844, Robert McClure in 1853, McClintock in 1855, and Nares in 1877.

The President of the United States and the Secre-

tary of the Navy accordingly recommended that Peary be recognized fittingly. Scientific societies of the world unanimously pronounced this the greatest geographical prize of the last three centuries. It is a matter of just pride that this honor has come to the United States. The committee believed that "ia the United States.

ascertainment of facts concerning the northern Arctic Cean; the general information he has obtained by living over twelve years within the Arctic circle; and finally having successfully followed, a carefully laid plan resulting in his reaching on April 6th, 1969, and bringing back to civilization the conditions existing at the North Pole, that Robert Edwin Peary has performed a most remarkable and wonderful service, that he has attracted the favorable attention of the civilized world; and that therefore the American people, through its Congress, shall render him thanks, and bestow upon him the highest rank of the service

Dr. Cook's remarkable tale and its subsequent dis-proval had instilled so much doubt in the minds of many people, that not all the committee were in accord. A minority report accompanied the majority report of the committee. At the conclusion of Capt. Peany's examination the accompanying diagram was exhibited, on which are marked the points in the vicinity of the pole where he had made his astronomical obs These points were determined by working out his observations and plotting them on the diagram. The diagram was made by Mr. Duvall, and was verified by Mr. Mitchell. The work of these two men, so far as the committee was able to ascertain, was the

as the committee was able to accurate, was the first and only effort made to verify in a practi-cal way Capt. Peary's maps or records. No doubt if the National Geographical Society had proceeded in the same manner, an unpleasant controversy might have been avoided. Mr. Peary was reluctant to submit to any tribunal other than the National Geographical Society his records and memoranda, his records and memoranus, recourse an assigned contracts with his publishers long previously which rendered it impossible for him to publish his records of scientific data at a time when the public clamor first arcse. Not only when the public clamor first areae. Not only would be have been subjected to heavy dama loss which he could not have m cause he had barely succeeded in extricating himself from debt incurred in connection with polar explorations—but he would have broken faith with his publishers.

The doubts which had been raised, however,

both by Peary's refusal to submit his to any other body but the Geographical Society. and also by the exposure of Dr. Cook, naturally had its effect upon the committee. There was not complete accord in awarding to Peary the nors so justly due him. Hence there minority report, the reading of which is not exactly instructive, but is certainly amusing. The leading light among the minority was the Hon. R. B. Macon, Representative from the First

District of Arkansas, who, to use the terms of The Navy, "gained fame by skill in coarse vituperation." It is alleged by The Nevy that on the floor of the House he referred to a reputable newspaper reporter as a "liar," and spoke of Peary as "near-hero," "alleged discoverer," and an "idle loafer." In heckling to which he was subjected by Mr. Macon, Mr. Peary conducted himself with dignity and certainly with great self-restraint, as the following excerpt from the records must certainly show:

Capt. Peary. I do not think I care to go tato a iscussion of general principles. I will state the facts, and also my determination of those facts, to the come or to any experts.

Mr. Macon. You are an explorer, so remited, and want to find out whether or not you knew what you were doing. When you send a man into the field to play he must know something about the work or he will not do much intelligent work.

or he will not do much intelligent work.

Capt. Feary. Specifically or precisely the magnetic pole is located somewhere here (indicating on map) near King William Land, just a little north of the mainland of the American continent. There is a gentleman here who can probably give you the pre-

Macon. We are examining you here now and

air. Macon. We are examining you here now said not examining the other sentiamen.

Mr. Macon. Captain, did you find any evidence of increase or diminution of weight at the pole?

Capt. Peary. I did not except the weight, of the massiness of the party and the dogs.

Mr. Macon. I mean change in weight except for last or food-stuff?

Capt. Peary. I beg your parton?
Mr. Macon. Did they change amount perhaps for lack of toodstuff?

a straight of a second of the

g Penry. Wet that I noticed; no. Did you find any decided atmospheric -7

Capt. Peary.

int there, it. Will you tell me, please, what that irly constant

Mr. Macon. I asked him whether the needle an-

swared to the primary or secondary magnetic pole. Mr. Butler. What are they?

Mr. Macon. Oh, they are known in science. Mr. Bates. Where did you find that question? Mr. Macon. They are known in science.

Mr. Bates. But I am not a scientific person

Mr. Daws I would be glad if the gentleman from Arkansas would explain.

Mr. Macon. The gentleman from Arkansas is g ing to ask questions, and he is not going to ask any

Mr. Englebright. Is he trying to test the Captain's nowledge on science by asking such questions ridiculous questions?

n. I have asked no ridiculous questions. Mr. Englebright. Did you ever hear of a primary

r secondary magnetic pole? Mr. Macon. Yes; I have.

Mr. Englebright. Where—in Arkansas? Mr. Macon. Where I have heard of everything else no; in Washington. And I want to say to the gen-tleman from California, if he intends it as a slur in regard to Arkanasa, that it is unworthy in him.

Mr. Englebright. I withdraw the remark.

I want it understood that Arkansas is Mr. Macon. I want it understood that Arkansas is the equal of California in everything in the world except a little gold in the earth and a few hungry fellows for an exposition.

Mr. Butler. I will ask the members of the sub-committee not to further interrupt you.

Mr. Macon. I am advised by a school of scientists that it is a physical impossibility for man or beast to

reach the North Pole, for the reason that the dimin-ishing centrifugal action—did you ever hear of that? Mr. Butler. I never did. I have heard of dogs and

sledges, though, Mr. Macon. For the reason that the diminishing centrifugal action and, in proportion, the increasing center of gravity near the pole causes a complete fall-ure of man and animal energy that produces a kind of paralysis of the senses and of motion, a paralysis of sensation in any part of the body, including the exercise of the faculty of the mind. Do you know any-thing about that contention on the part of scientists?

Mr. Butler. That is an indication of lunacy, is it not, or feeble mind—a sort of combination of the

solids and fluida?

Mr. Macon (continuing). So that it would be almost impossible for them to exercise their independ-ent functions so that anybody could ascertain a real -intelligently ascertain a fact.

Mr. Butler. What was your observation?

Capt. Peary. I have never heard of the matter. Mr. Butler. You never did?

Capt. Peary. I never heard of the subject matter

Mr. Macon You never heard of that before? Capt. Peary. Never heard of that before. Mr. Butler. Never heard of the theory

Capt, Peary. And I have not noticed any such con-

dition or effect or circumstance.

Mr. Butler. On either man or dog! Capt. Peary. On any member of my party or dogs.

Treating Cutaneous Disease by Means of Cold

AN interesting and promising method of treatment has lately boffs employed in various diseases. It consists in the application of intense cold, to circumscribed and easily attainable parts of the body—chiefly to the external skip, but also to the mucous limings of the cavities of the body.

This method, like many other apparently violent therapautic procedures, appears to have originated in America, where it was employed by Pusey. Soon afterward it was shown at the dermatological congress eid Frankfort three years ago. Practical methods

held, in Frankfort thrie years ago. Practical methods of aggiring the principle have since been developed, more in sea successfully, by many German physiciant. This threshment of culmonous diseases by the application of old produced by liquid air was attempted in designary long ago, but the results were, meaning the physician positivities of liquid air hild. The employment of excessively low temperature, if he have loss of the produced the liquid air hild. The employment of excessively low temperature, "The have feet of the produced that the temperature of surjects and soon, "11 day. F., is quite figs." "Surject and the produced the produced that the temperature of surjects and soon, "11 day. F., is quite figs." "Surject and the produced that the temperature of surjects and survey."

WATER TO STATE OF

This snow is easily produced by allowing liquid carbonic acid to flow from a commercial cylinder of the compressed gas into a porous vessel, which retains the snow formed by the refrigerating effect of evapora-tion. This snow can be molded like ordinary snow and can be used directly for therapeutic purposes, but it must not be grasped tightly with bare hands, as it produces "burns." The physiological effects of its application, indeed, resemble those of some burns, but are usually beneficial, rather than malignant Axmann, who describes this new therapeutic proce dure in Die Umschau, has never caused a perman lesion in any of the hundreds of cases which he has treated, nor has he heard of any such accident. He has devised a very simple and convenient apparatus, consisting of a frame which securely holds the carbonic acid cylinder, with its mouth downward, and a or pouch which is attached to the mouth of cylinder directly or by means of a short tube. By estedly opening the stop-cock for a few seconds, liquid carbonic acid is expelled in small portions into e pouch, where the evaporation of part of the liquid freezes the rest. The snow that accumulates in the to % inch in diameter and 4 to 6 inches long, in rhich it is compressed by pistons until it issues from the mouth of the tube as a solid cylindrical or poly-gonal rod, which can be applied directly to the skin. The depth to which the action penetrates can be

regulated by the pressure with which the rod of car-bonic acid snow is applied When the fiesh is touched lightly it is protected by a stratum of carbonic acid gas which its heat evolves from the enow, but this insulating coating of gas is squeezed out by vigo This effect, which is known as Leiden pressure. frost's phenomenon, accounts for the fact that carbonic acid snow can be touched lightly with impunity it "burns" the fingers when grasped firmly.

The duration of the treatment is measured by sec-

Ten seconds' application, with firm pressure, raises a blister and entirely destroys the outer skin: or even thirty seconds may produce deep-seated and serious effects. If proper caution is observed ever, no permanent injury results. The frozen and pitted skin presents an alarming appearance, but in seconds the normal aspect has returned and the pain, which is usually slight, is entirely gone Inflammation, swelling, and blisters come later, but in a week a new skin, often free from the imperfec as of the old one, is formed.

The treatment is especially efficacious in a variety recable and disfiguring, but not serious, affect tions of the skin, such as the red, blue or brown moles which sometimes thickly cover the face It also gives excellent results in obstinate carrer of the skin (cancroid), and various small tumors of the nature of warts The carbonic acid method is particularly indicated for the treatment of small blemishes of the skin, as it can be applied without causing serious

pain, scars or any injurious effect.

Psoriasis, a rather common skin disease, which though not dangerous is very annoying, and which has rarely if ever been completely and permanently cured, has in recent years been treated successfully with ultra-violet rays and Roentgen rays. Even the latter, however, leave patches of eruption, the removal of which by repeated application of Roentgen rays would be both expensive and dangerous. These patches yield to the cold treatment, which is preto ray treatment in all cases of small local infection with psoriasis.

The new method will also be found useful in sur-ery A pencil of solid carbonic acid can be introgerv gery A pencil of solid carbonic acid can be intro-duced into the masal cavity or a wound fistula with-out difficulty, and is a safer and more efficient agent for-the destruction of morbid growths than the electric cauterising needle, the temperature of which is variable and uncertain.

Some Effects of the Foehn Win

THE foehn is easily the most famous wind of the Aips, yet there are few good descriptions in English of its many and far-reaching effects upon human affairs. Thanks to Hann, the mechanism of this wind is well understood: the textbooks of meteorology tell us how it acquires its remarkable heat and aridity, in traversing the mountains, but do not give us an adequate idea of the way in which these ties influence the lives of the people who dwell where the foohn is prevalent.

Innstruck, the capital of the Tyrol, is a favorite haunt of the foelin, and from this place have come the most complete scientific discussions of the wind; viz., the "Innsbrucker Föhnstudien," which have been in course of publication for the past six years. How-ever, perhaps the most graphic picture of the effects of the feels is contributed to a recent number of Symona's Meteorological Magazine by an anonymous resident of Innsbruck

At Innsbruck the foehn is the wind -- the only one At innspruck the local is the wind—the only one that counts. "Es geht wieder der Wind!" says the shopkeeper who is serving you, while the foeln is doing its best to break his windows, and is envelop ing the passers-by in clouds of dust

The precursors of the fochn are promptly recognized The atmosphere becomes pure and limpid, distant bills are a marvelous transparent blue Soft disphanous clouds begin to gather in the southern sky, a few fleecy clouds form around the mountain summits, and at times these develop with incredible swift ness into a great bank—the "foehn-wall"—blotting the southern horizon from view

Most remarkable is the sudden rise in the tempera ture. If it is summer the atmosphere becomes stiffingly hot, if winter the keen frosty air turns mild and close. This wind often blows with great violence. and unless one's windows are promptly closed everything in the house is speedily covered with a thick layer of dust

linon many people the feebn has a nathological upon many people the foems has a pathological effect, the symptoms of which—headache, lassitude, depression—are classed together under the term "foehn-sickness" Trabert has endeavored to explain this as the result of the fall in barometric pressure; Czermak and others refer it to the electric disturbance of the atmosphere that accompanies the foehn

spring, frost and snow disappear as if by magic at the touch of the foehn-hence called the Nchn fresser ("snow eater") This fact has a sinister significance for Innsbruck, as a favorite center for win-ter sports. The ski-runner beholds with dismay the complete disappearance of the snow, in a few hours, from the mountain slopes; while the skater sees the ice turning to water beneath his eyes. More serious the effect of the foehn in loosening the dreaded avalanche. To offset these disadvantages, the foehn is a valuable asset to the agriculturist Innsbruck owes its crops of mains to the foehn, the cultivation of this plant would be impossible without it. mild temperature brought by the foebn is due, also, the occurrence at Innsbruck of semi-tropical types vegetation-survivals of an interglacial period that eded the great Ice Age

Bad weather-rain or snow-almost invariably folws the foehn at Innsbruck

The most remarkable and disastrous effects of the foehn are, however, to be sought, not at Innsbruck, but in certain Swiss valleys, where the extreme dry ness of the wind, by reducing all woodwork to the condition of matchwood, increases the danger of fire to such an extent that in certain localities fire of any kind, from that of the kitchen stove to that of a lighted cigarette, is strictly prohibited during the foehn There are also regions where the foehn blows far more violently than at Innsbruck, uprooting tre unroofing houses, etc

The article above referred to does not furnish details regarding these more serious effects of the foehn, but er who desires to pursue the subject further so in Gustav Berndt's "Der Alpenföhn in may do so in Gustav Berndt's seinem Einfluss auf Natur- und Menschenleben," pub lished as the eighty-third supplementary number of Petermann's Mittellungen. Here we read of the great "foehn fires" that have three times laid in ashes the village of Altorf; that have raged four times in the town of Glarus; and that half destroyed the quaint old town of Meiringen, February 10th, 1879. Many Swiss villages have their fire-wardens, who patrol the streets when the foehn is blowing, and see to it that the laws requiring all fires to be extinguished under such circumsta res are rigidly enforced. Fires for cooking are permitted during specified hours, unless the foohn is unusually severe and persistent, when even this meager privilege is denied, and the villagers must subsist on cold food

The Loss of Power in Gas Engines at High Altitudes

a recent issue of the Engineering Review there I will be found recorded the case of a large gas plant which was some time ago exported from Great Britain to a British colony and erected at the location several thousand feet above sea level. The engines did not give the power expected from them, and several ons were advanced to account for this deficiency. It was finally concluded that the loss of power was due to the altitude of the power station Upon investigation of the theoretical and practical considerations involved it was found that there is a loss of about one per cent of the indicated horse-power for each 1,000 feet increase in elevation. The effect of an increase in elevation on an engine with a low ratio of compression is slightly less than on an engine with a high degree of comp

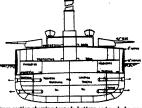
Battleship versus Destroyer

The Struggle Between the Big Gun and the High-speed Torpedo

THERE are not wanting some careful students of the trend of naval construction who believe that the ultimate arbiter of future battles on the high seas will be the torpedo, and not the big rifled gun. This conviction is based upon the ever-increasing accuracy and ever-extending range of the torpedo and upon the and ever-xtending range of the torpedo and upon the great improvement which is being made in torpedo vessels, and particularly in those of the submarine type. Also, some of the beat naval architects of the day are studying the question of building the torpedo-batt destroyer on battleably lines, giving her sufficient size and speed to overtake the battleship, and sufficient armor to enable her to run in within easy striking range of the enemy.

At the present writing, so great is the power and so unerring the accuracy of the big gun (witness the eccent target practice of our ships against the old "Texas") that except under the very rare conditions of a surprise attack in fog or thick weather, the bigbattleship has the torpedo craft at its mercythe destroyer is too frail and the submarine too slow. to have any hope of getting near enough to a modern

dreadnought to launch the torpede with any chance whatever of a successful hit. But when it comes to the question of building destroyers of the size, speed and protection of the extraordinary



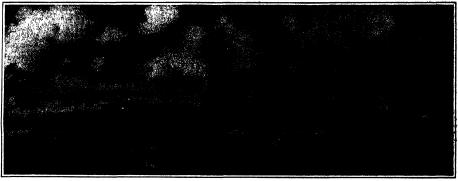
edo battery on tv tected by side armor and three protective de

the second part of this article, the problem has an entirely different supper. It is gutthe copies that it a significance apper. It is gutthe copies that it a significance is a significant of the significance in the significance is significant to the significant that the significance is significant to run the guntlet of shell for from a modern nought, and draw man enough to discharge her than the significant significance is significant to the significance is significant to run the guntlet of shell for from a modern nought, and draw man enough to discharge her than the significance is significant to the signifi

nough, and draw near enough to discongregate are side of 21-inch, 40-knot torpedoes, before she was it to the bottom, as she ultimately would be.

The chances of such a vessel getting within pedo range, however, here been greatly radioopt pedo range, however, have been genetly reduced by the introduction of 13½ and 14-inch guns as the maig armanest of battleships. The 14-inch gun, of which there are ten, will form the main armanest of the two mighty abips, 'New York' and "Texas," the construction of which is about to be undertaken at the New York Newy Yard, Brocklyn, and at the yards of the Newport News Shipbullding and Drydock Com-

(Continued on page 416.)



entent, 27,000 tons. Conl and oil, 2.550 tons. Armer: Belt, 9 inches to 13 inches; gun positions, 18 inches. Armanments, Ten 14-inch 45-caliber guns : twenty-one 5-inch 50-caliber guns. Torpodo tubes, four submerged. A 27,000-ton big-gun battleship ("New York" and "Texas").

A 15,250-ton termide beilledde. (Beil

A New Aeroplane Passenger-carrying Record

Louis Beguet's Feat of Transporting 11 People 8 Miles Across Country. Description of the Machine

COMPUTED a meanth elapsed wer the wonderful rec-Dard of Le Markin, in his Bistrict monoplans, in within his warried usine passengers, was greatly surpassed by another French ploneer, M. Brayust. On March 1864, shew; the acrofrome of Le Brayust, on March 1864, shew; the acrofrome of Le Brayust, or March 1864, shew; the acrofrome of Le Brayust, or March 1864, shew; the sacrofrome of Le Brayust, or his bilians. Rising into the sir without any perceptible editions, he made a straight-line slight of 5 kilomaters (5.1 mises) at a speed of 60 kilometers (5.5, mises) an hour. The weight of the machine complete was 500 kilogrammes (1.2328 pounds), and the live load transperted was the same, so that a total weight of 2,46136 pounds was carried through the six at express train speed for a distance of over three miles. The average weight of the passengers carried was 50 kilogrammes (1104 pounds). We believe that this is the first time on record when the live load carried has equated the complete weight of the machine.

With this demonstration of the possibility of carrying a dozen or more passengers, there is no doubt but that zeropiane flights with several people for pleasure purposes will come into vogue early this summer.

The day after Breguet made his great passenger-carrieng flight, Roger Sommer got off the ground in his biplane with twelve passengers, but he succeeded in making little more than a jump.

M. Louis Breguet is one of the foremost French aeropiane experimentors. He has been at work at Doual for a number of year past, and has gradually devojeed one of the most partet deropianes thus far constructed. Previous to his recent experiments he built a palicopter white working in conjunction with M. Richet in 1987. This massilian sujecestilly littled a total weight of

1,100 possesses.

"dea-fire jake Brequet biplane, its fine lines and simplicity of construction are the result of control and the result of control and of the simple posses. Just a result of control and the simple posses, and the won-control and

real faces by its great litting power, and the winders. Similations with which it makes long filled after its matter has been stopped. Only a year ago, or appril sth. 310, Forquet carried three passengers in an excellent flight at Doual, and attracted the attenting of the entire varieties world. Later, at Rouen, Releins, and other aviation meets, his biplane, driven by himself or by Bathiat, won many prises for passenger carring, and showed itself to be extremely speedy and reliable During the French army mane speedy and reliable During the French army made some excellent reconnotisting flights. On September 1st last Phigiated carried Capitalin Maddot and made some excellent reconnotisting flights. On September 1st last live load of 780 pounds. Only a few weeks later the carried ive passengers and made an accellent flight, the total live load being 860 pounds. These performances of passenger carrying were unquasited until carrying in the present year, when they were besten by Sommer and Merted. On December 31st. 1819, Breguet, while competing for the Mitchelin Cup, made a flight of 205 milles at high speed.

muse at high speed.

E. Breguet is one of the French constructors who favor steel tubing in place of wood. The front end of the play of the Breguet biplane is equare in cross section, the four corners consisting of four seamless steel tubes, thereaded at their front ends. The two

titles showeded at their front ands. The two forces showed covered and pass through the protest and the seas through the protest will as at the rear of the R.B., moter. The topper tubes of the body of the proper types and the proper types part of the selfer crank case. This simple method is significant, because it distributes the pull of the protest of the protest

Marie La La Marie de la Carte de la Carte

froat edge. U-shaped ribs of sheet aluminium are fastened to these by an ingenious elastic joint. In the case of the lower plane (which is in two halves), a connecting tube passes through these tubes and is securely fastened to them. Mounted upon this connecting tube is a lever which can be moved by adjusting nuts on a bolt extending from the end of the lever through a short tube that projects from one of the two vertical struts above mentioned. By adjusting this lever the wings can be set at a suitable angle. In a recent following-plane biplane, brought

the woman garling garl

The biplane in flight, fully loaded.

The live lead equalled the weight of the biplane, each being 1.82%, pounds. The sketches show the mounting of the motor and of the end strats connecting the planes

STEEL LEVER



Bruggard of the effect of his hiplane, oboving 10 passengers.
The elevant passenger a law is higher from view in the photograph. Statch have shown an examinate the displaying eagle of inclines of the livery played to the property of the companies that which gain gain of the companies the companies that which gain gain of the law played to the companies the companies of the law played to the companies of the com

out by Breguet, he has arranged for the adjustment of the angle of incidence of the planes while in flight— —an adjustment that was first brought out by M. Peiterle on his monoplane.

The sketch below the photograph of the machine in flight shows the mounting of a vertical strut of the Breguet biplane. As can be seen, the strut is phytoted upon the cross pin of a sort of struy, so that it is capable of a slight movement hack and forth. The double guys for braring the planes are shown in this illustration. One of the main points of the Breguet biplane, however, is the use of strely rods in place of guy wires. In addition to the two vertical struts at the center of the machine, there are but two other struts, one near each end, as can be seen in the photograph. The use of so five struts and guys, as well as the adjustability of the planes, make this machine one of the speedlest biplanes in existence. In addition to this, it holds the record for the planes is an even curve having a thick, blunt front edge and narrowing to a fine edge at the rear. The upper plane is longer than the lower one. Its spread being 43½ feet, as against 32½ of the lower

plane The width of the planes is 53, feet, and the total supporting surface 408 square feet. The main feature of the Brezuet biplane is the crueiform tall which is flexibly mounted at the end of the body in such a way that if it is hit beneath by a gust of wind it will give upward and tend to steer the machine in that direction, thus counteracting the tendency to dire that the machine would have if the tall were rigidly mounted. In this manner a considerable degree of automatic stability in a foreandart direction is obtained The transverse stability of the machine is maintained by warping the wings in the usual manner. The motors used by Breguet have been the Gnorn, Renault, or R. E. P. One of the sketches shows the front end of the machine with an R. E. P. motor fitted The

military Breguet biplane, on account of its steel-tube construction, can be taken apart and packed for transport in half an hour.

For further particulars about the Breguet hiplane we refer our readers to our new book on "Monoplanes and Biplanes," which has been specially written by Mr Grover Cleveland Loening, M A, and which will be off the press in two weeks 'time

The Gordon Bennett International Aviation Trophy

By Earle L. Ovington, Licensed Aviator

If the Frunch do not carry off the banner this year in the world's greatest aviation contest it will not be because they are not making elaborate and carefully planned preparations to do so. They have never quite recovered from the shock of surprise given them by Glean Curtiss when he, an American aviator flying a machine of his own construction, invaded their midst and won the big event at the first-international aviation meet, held at Rheims in 1909 On this occasion Curtiss, up to that time practically unknown abroad, surprised the aeronautical experts by beating the fast Preach monoplanes with a biplane. By winning the

Gordon Bennett trophy in 1909, Curtiss brought the 1910 contest to America, and the race took place at Belmont Park last November. Again a surprise awaited the French, for in this case C Grahame-White, an English aviator, proved the winner To be sure, the French led until the last lap; but an unfortunate accident prevented Leblanc, their champion, from finishing a race in which he was leading. The French had one satisfaction, however, for Grahame-White used a French Blériot monoplane, although being himself a member of the English team, the trophy went to England. Consequently, on English soil-or, more correctly. English soil-the contest will be fought this year, the date set being July 1st

This double defeat has acted as a spur

This double defeat has acted as a spur upon the French aeroplane makers, and great is the activity among them to produce racing machines, in the hope of bringing back to France the much-coveted and twice-lost Gordon Bennett trophy A briof consideration of the most promising aeroplanes which are being built for the French

(Continued on page \$17.)



Write to Handy Man

HE Editor of Handy Man's Workship is so please I with the vote in favor of the Department that he has decided never to close the polls. He wants handy men to continue to send him their suggestions and criticism, whether favorable or not. Only one man has voted against the Department. The gist of his letter was published in the issue of April The Editor is always glad to learn of new kinks and pays for them promptly, if they are available.

An Adjustable Rose Reamer

By C. S. Bourne

I N a general jobbing practice it often becomes necessary or desirable to ream holes that have been I sary or desirable to ream holes that have been previously drilled a size a little smaller than the desired finished gage Redrilling with a twist or flat drill may be near enough in some cases, while in others there may be required a driving or may be a



An adjustable rose rea

good running fit for a piece already turned. There may be a number of these holes to size correctly, or alike, and the nearest flute reamer available is a trifle small or large Under the conditions it be-comes a question of quickly making a tool near enough to the correct size to do the work satis-

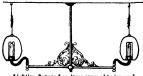
The so-called "rose" reamer is a tool quickly made turning a piece of tool steel to the correct size and length, and relieving it slightly from the cutting teeth back toward the shank. After rounding the end, file the teeth with a sharp half-round file and harden. once made a modifications in the rose reamer like the skeich by making it slightly adjustable, where I had a number of holes to size with slight variation With a back saw I made a slot about one-half inch deep, and then by inserting a thin wedge in the the very slight change needed was easily effected by driving it a little, thus springing the two sides apart sufficiently for the purpose

This plan may be a useful scheme to others in a like situation

Light Fixture for a Shipping Room By Albert Mayoh

THERE are many places, especially in shipping rooms, foundries and machine shops, where a brighter and more intense light is desirable, but is almost entirely precluded because of the Hability of accident and the cost of replacement. To those who are meeting this problem, the accompanying sketch showing a device adopted by our "utility man" in the shipping room of a large city "public market" will be useful

We have several lights, near the elevator, and the grocery chutes and near a revolving carrier chain



Lighting fixture for places exposed to jars and draughts.

(which we use for carrying the baskets from the cellar to the sidewalk for the teamsters) where we have had an unusually large number of broken mantles and chimneys. To lessen the breakage we have adopted the following device:

A metal ring is suspended from the ceiling by a steel wire, to which is attached a curtain spring I'pon the ring is a small plate with a hole large enough to receive the Welsbach burner. The burner is then placed on the mantle and used without a chimney. Thus the spring takes up all the vibration, and the rubber tube gives enough freedom for the burner to swing whenever it is struck.

We do not use the glass chimney on the burner, but burn the mantle unprotected and find that it lasts as long if not longer than with the chimney and the light is fully as bright even when the light is in a draft, while the air ne longer acts to break a chim ney, but merely swings the support.

A Novel Pipe Wrench By O. Ruehmer

A MONG the many uses to which old files may be put the following has one advantage, namely that if properly used it will not mark brass or copper pipes. Take an old 12-inch file, half round preferred, and grind



the flat side fairly smooth, just enough to remove the points of the teeth for a short distance from the end. Next anneal the end and bend it into the shape shown in the sketch. The size of the curve will depend on the size of the pipe the wrench will take. However, a file bent as shown around an inch pipe will take three-quarters At the back drill a hole, which is tapped for a long set screw, and your wrench is com-plete. As stated above, this wrench will hold brass or copper pipe securely without marking it.

How to Rebore a Crank-pin Hole in a Locomotive Driving-wheel

By H. D. C.

WHEN a crank pin has become so worn that it VV must be replaced with a new one, the hole will be found out of round, due to the knocking of the main rod.

There were some new pins to be set in the driving

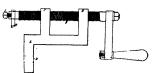


Fig. 1. - Tool for reboring crank-pin holes.

wheels of a locomotive, and when the holes were measured they were found to be out of round so that it would be impossible to make a driving fit. It is quite a task to remove the wheels from under an en-gine and take them to the machine shop to be rebored, and so after some hard thinking the following method was evolved: A tool was made as shown in Fig 1. Angle plate A was made of machine steel. The face of angle was machined at B. A hole was then bored and chased through both ribs of the angle plate shown at C and D. The screw E was made machine steel and was two inches in diameter chased to twenty threads per inch. By using a screw having this number of threads it was an easy matter to turn it while taking a cut through the bore of the whe as the wheel was of cast iron. There were two holes in the angle plate (F and G, Fig. 2). These holes erved for clamping the device to the driving wheel,

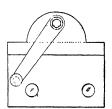


Fig. 2. -- End view of the reboring tool.

The screw was run back so that it would clear the and the tool was placed in position, as s and held there by the means of a set screw I. Wh the device was clamped to the wheel the tool was at justed out to take a cut through the wheel. The acres justed out to take a cut through the wheel. The serve was revolved by means of the handle, and owing the the fact that the pitch was very fine the feed was so light the handle could be easily turned.

The hole when finished was round and straight and.

served as well as if done in the machine shops.

By W. D. Gr

WHEN an ar hands or a chair rung is freshing much time is apt to be wested, and serforis design ago is sometimes done, through misguided efforts to remove the end from the eye or hole; yet it is a simple matter if one goes at it rightly. There is not the



ovkie a broken az handle

slightest occasion for heating in the one case marring in the other. Bore a hole through the plug with a bit or drill small enough to insure against striking the sides of the original hole; then, with a narrow chisel, cut a slot from each of opposite sides of this hole to the outside of the material to be removed, as shown in the photograph. This will leave the plug in two separate parts, which, if they do not drop out of themselves, may be easily knocked out or split out with the chisel.

If the problem should happen to be that of a handle which is secured by an iron wedge, then a small hole drilled through, close to each side of the wedge will make an opening through which it may be punched out, and from which to chisel the slots as illustrated. In cases where metal is apt to be encountered it is best to use a twist drill for the boring, as such a drill works very well in wood and is not injured by mod-erate contact with metal, while a bit would be apt to be rained

Direct-Indirect Lighting Fixtures By A. R. Van der Veer

AST week's issue of the SCIENTIFIC AMERICAN had Lemuch to say on the subject of direct, indirect, and direct-indirect filumination. In the first case, the source of the light is not concealed, and is objection-able for the reason that it produces considerable glare. In the second case, the luminous source is entirely concealed and the room is illuminated by reflection from white walls. In the third case we have



A handy man's direct-indirect lighting fixture.

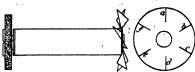
ibination of both systems, which is gen considered the best system of illumination. The writer recently had occasion to study these varies 376 system, and undertook to spirly them without properties, and undertook to apply them in his own bouse. He was using in the liberry a particularly bed form of flumination. This conglisted it is a district drop lamp, with a globe of fropted plans. The light source was see low in the room that the flash was articularly observed in the vision of the lamp, while remote parts of the properties.

The Late Control

effect even though the room was but twelve rest sinces. The enert was not greatly improved by until in addition an incandescent mantle on one of the reality gas fixtures. To remoty these conditions, the following beloism was carried out: The globe of the sincy itseys was inverted and burig by means of the first was not in the celling. A 40-watt tungsten king was suspended within the globe, as shown in the accompanying illustration. The shaps of the globe was such that a special form of clip had nade to provide a hold for the chains. es of soft flat brass were bent to the shape indi cated in the detailed view, so that each could be hooked over the rim and had a projecting portion which fold the curve of the glass below the rim lower the threaded through this portion of the clip and was tightened up against the glass. Thus a very firm hold was provided in a simple manner. This fixfirm and was provided in a simple manner. This intere was suspended at a height of 8½ feet from the floor, so that it would easily clear the head of any one passing under it. The frosted exterior of the globe diffused the light, while the pollshed interior surface acted as a reflector, casting the light up against the white ceiling, whence it was reflected again to the room below. Thus in a single fixture, a combination of diffused, direct light and indirect light was obtained. The drop lamp previously used was fitted with a 16-andle-power carbon flament lamp, consuming 56 watts, whereas the tungsten lamp consumes but 40 watts, whereas the tungsten lamp consumes but 40 watts, and far rated at about 35 candile-power. The tungsten lamp gives 25 hours of light for 10 cents, while the less brilliant carbon can be run for only 18 while the less orlinant caroon can be run nor only is hours on 10 cents worth of current. The entire room is lighted up by the new fixture with a soft light, in which there are no very heavy shadows. One can read with comfort anywhere in the room, though, of the most intense light is to be found directly under the fixture.

Fan on Grinder Spindle

THE writer saw an ingenious little kink the other day while walking through a railroad shop. The operator of a grinder was troubled with the emery dust,



Fan on the grinder spindle.

but overcame the difficulty by fitting a fan on the grinder spindle. He took a piece of galvanised fron sheeting and half it out as per aketch. After drilling a hole in the center and cutting it along the lines a, b, c, d, c, and f, he fitted the disk upon the spindle and twisted each section to form a fan. The pieces being ground were link bushings, and the table traveled in line with the enery wheel. The fan drew all the emery dust, etc., from the wheel, and blew it away at the back of machine

Workshop Notes

Hardening Tool Steel.—When hardening tool steel, if extreme hardness is desired sprintite some commandate sait on the tool before placing it in the Sire, and when the sait melis and runs over the steel it will act as a flux. When the steel has been brought to the required heat, plungs it in clean water. When cool the tool will be hard and free from scale and will not crack. Then draw it to the proper temperature Steel treated in this manner will give good results.

Prevent Breaking of Center Drill.—The great trouble with combination center drills is that you have the deal manufacture of the deal manufacture of the deal manufacture of the deal manufacture of the drill part does not cut large scoops to clear it self, thus making it whind was vegetable for break, and stars breaking it is usually not significant it is impossible, to remove it except by admissible. All this trouble his, to remove it except by admissible. All this trouble his, is remove it except by admissible. All this trouble his, is remove it except by admissible coupter drill with one lip, is little-temper than the other . The drill will then out figure float, and will out taken, and if the point does deaden to break, with a little-pusping the place will deal out, as the hole will be larger than the point of the drill with the self-will.

of the organ.

This diplies Cleed for Supplication Providing is headled in the suant work strop than an assortment of wire pipels from 4 inches to 10 inches or larger, an admirishment of blants unto to fit the spitce when threshed and a set of right and dids. They can be used it; sharp ways where extra strength is required by Alphanille give onds, directing them through with a

100

washer over the head, and tightening them up with a washer over the head, and tightening them up with a betaken apart, holes must be bored first. With an assortment of spikes the right size can nearly always be found for the job without cutting, though a hack saw will add to the efficiency of the outfit. I have made the timer points for my gasoline engine out of 6-inch nails. I can make half a dozen of these in dittenminates at practically no expense. Before I found this out 1 paid \$1.50 a pair for them.—Alex. Roserston.

Repairing a Het-water Radiator, -- Through neglect ss I went away and let the water r main in my hot-water plant. I was gone for about a week, and when I got back I found the plant frozen up and one of the radiators burst. So I made enough fire in the boiler to melt the ice and drew the fir and let the water out of the pipes. I then repaired he crack in the radiator in the following manner, and it is holding water as well as a new radiator: mixed litharge with glycerine to a stiff paste, and forced it into the crack with a putty knife or some similar instrument. After filling the crack I let it stand over night, and on starting the fire in the boiler in the morning, the water was, of course, cut off from the cracked radiator. As the water warmed up in the pipes, it heated the radiator, causing the paste to set. The water was then turned on in the radiator, and there were no signs of a leak. If this mixture is properly applied the job will last as long as the radiator. The one I repaired has been in service three years since the break .- H. D. CHAPMAN.

A Few Remarks Concurring Blue Printing.—To make a perfect print from patent office bristol board without recourse to tracing the drawing the writer has found the following scheme excellent: Place the bristol board as completed with face up in the frame of a blue-printing frame and upon this face a sheet of negative paper. Expose the required length of time and develop. With the dried negative a perfect blue line print can be made in the usual manner. To one who has tried to blue-print patent office bristol board direct it is known that the lines are blurred, due to the thickness of the paper. By

as anown that the times are outre.

due to the thickness of the paper. By placing negative paper as outlined shove in contact with the link a perfect negative results, which naturally produces a perfect bise line print. To make a beautiful blue, blue-print, with clear white lines, over expose the print until it is a hopeless case with the usual water wash, then bring it back by a dilute solution of hydrogen perceive, about one to four. This can be applied with a brush outside of the wash tank or it may be poured the wash tank or it may be poured.

directly upon the print in the wash tank If the latter is done, however, every print must be treated in the same way, as peroxide added to a properly exposed print will bleach it.—J. F O'BYRNE.

Cleaning Shellac Brushes.—A shollac brush is easily and readily cleaned in soap and water if it is taken in time and the work is done quickly, before the shellac has had time to set. Alcohol is generally used for this purpose

Detecting Lesks in a Gaseline Tank.—The owner of an automobile has been running one for two years. The gaseline tank did not show any leaks that the eye could detect until quite lately, when he used luistrating oil with the gaseline mixed together. The leaks then were very easily detected, as the lubricating oil which came through with the gaseline would stand on the surfaces without evaporation. When only gaseline was used it would get through a very slight leak and evaporate so quickly that the eye could not detect it.

Making Gaskets Baselily Removable.—To make a gasket for a cylinder head tight and yet permit it to be removed readily when desired without danger of tearing the surface of the gasket, rub on the surface of the gasket that comes in contact with the cylinder head black lead and ary powder so that it gives quite a shine. Use the same black lead on the cylinder head surface. Black lead should be used on bolts or nuts that are removed occasionally. It allows you to turn them tighter when turned down and also to start them more easily when removed.

Holding Brass Pipe in a Visa.—Whon cutting threads on bruss, ripp it is often desirable not corated or bruise the brass pipe. The mechanic usually makes weeden have by taking two pieces of wood and boring a hole, on the line where they are joined together. The Pipe is then placed between the laws in the half round holes and clamped tightly in the vise, which will not always hold securely enough when using the pipe diff. A little produced rosin put on the half round response of the wood jaws will grip the pipe sufficiently for the word.

Removing Old Boiler Tubes

By A. F. Bishop

A LMOST any mechanic can remove old tubes from a boiler if he understands the wrinkle.

A cape chisel is used first, as shown at I in the accompanying drawing, cutting through the tube just under the tube head and forcing the metal chip in



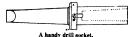
Removing old boiler tubes.

toward the center of the tube. Next use the flat chisel, as shown at 3, cutting out the small connection on the end of the tube just above the point where the cape chisel was used. The lower end of the tube does not need much chiseling, one cut with the flat chisel is about all

The lower end is then battered in with hammer, also the upper end, as indicated in tube 2. Now the tube is ready to be lifted out by hand, which generally does not bother much.

A Handy Drill Socket

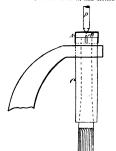
THE line cut shows a simple device that may be applied to an ordinary drill socket so that the drill may be quickly removed without stopping the drill press. The ring A is made a sliding fit on the socket as shown The edge of the ring A is rounded as indicated at C A screw B passes through one side of the ring A, and through the tang belie of the



socket and screws into the opposite side of the ring When the drill is in place, and the machine is running, the drill can be easily removed by a light rap on the rounded edge of the ring. And when the drill has been removed another drill can be placed in position while the machine is in motion

Taking Speed of Machines Not Provided With Centers

H AVING occasion to take the speed of a die sinker not provided with the usual centers, the writer made a brass shell, as shown at A, and slotted it at



Taking speed of machines not provided with centers.

four equally distant points, as shown at B. This was simply altipred on to the end of the spindle C of the machine and then the specel indicator D could be inserted in the countersink hole in the end of the shell. This little kink worked as well as if the center was in spindle.

Railroad Clearance and Curvature Car

THE new clearance car which is here illustrated has just been placed in service on the Pennsylvania Raliroad lines east of Pittaburg and Erie. It was designed in the office of the engineer of main-

tenance of way, and is being run over every division as rapidly as possible in order to secure correct measurements of the distances from the frack to projecting portions of station buildings, tunnels, bridges and other objects. It is also designed to indicate automatically, while moving on curves, the elevation of the rails and the degree of curvature.

The rax, which is 54 feet 8% cache long over all, and 30 feet between truck centers, is built entrely of steel. At the front end of the car where the templeta are located is a second floor at an elevation of 9 feet 8 inches above the top of the rail Both floors are for use in taking measurements from the templets. The second floor is reached by steel stairways on each side of the main templet.

All measurements are taken at the center of the wheel truck, from which clearances are computed The main templet, which is exected directly over the center of the truck, has a width of 10 feet between elevations of 2 feet and 12 feet above top of rail, exclusive of the fingers or feelers attached to the sides. From an elevation of 12 feet above top of rail, the templet recedes toward the middle of the car at an angle of 45 degrees, reducing with the width of the templet to 4 feet at the top, at an elevation of 15 feet above the top of the rail.

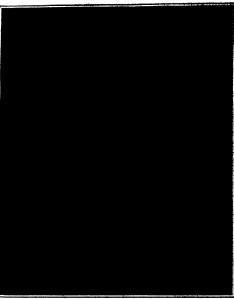
Immediately in front of the main templet is constructed an auxiliary templet, designed to measure sverhead bridges, tunnels and other objects between elevations 17 feet and 20 above the top of the rail. This auxiliary templet has the same dimensions as that part of the main templet between elevations 12 feet.

and 15 feet. It is supported on a center shaft inclosed in an upright cylinder and is capable of being raised to a height of 18 feet by a crank and ratchet arrangement on the floor of the car.

Inclosed in steel cylindrical boxes with translucent glass fronts facing the templets is a series of electric lights which extend from the floor of the car on each side thereof to a beight of 15 feet above top of rat-The well diffused light thus obtained makes it possible to take measurements both day and night, as well as in dark tunnels.

The fingers or feelers attached to the sides and the top of the templets are 2 feet long and are spaced 6 inches apart. They are hinged to the templets and held in the different positions by friction. Attached

to the fasiners and the stde of the templet are graduated scales which tadiopse automatically the distance from the rim of the templet to a side or overhead the ject. In addition, a small board equipped with a side of feelers spaced one innh agart has been provided measure cornectes of roots, or shelter shock, or other measure cornects or roots, or shelter shock, or other



The flexible fingers projecting from the frame come in contact with the surfaces of tunnels, bridges, platforms, etc., and autematically record their outline.

NEW STEEL CLEARANCE AND CURVATURE CAR

irregular objects close to the track. This board is detachable and can be fastened to the side of the templet at any point desired. As the car passes over a curve, an attachment on the rear truck of the car indicates the degree of curvature on a scale inside of a cabinet, which has been erected in the middle of a cabinet, which has been erected in the middle of a cabinet, of a long pendulum, suspended vertically, which indicates automatically the elevation of one rall of the track over the other. The side of this cabinet facing the main templet has been provided with a plate glass window, which enables the operator of the car to read the degree of curvature, or the elevation of the rail at any time.

With all of the attachment working automatically

in he provides by fath absence makes appeal and the new is represent at a specific for pulley have take to recognize at times in units in many one of the way of regular praise.

Though two men can operate the new continues the saling the residings of the scales and the side proording them; where cheerings are close and presented a region.

Armored Cars in the Mexican Revolution

PROFITING by the example of the British in the Boop War is Bouth Africa, the Massian government has constructed three armment has constructed three armment has constructed three armto be used on the northern hranches of the National Railways of Marico in putting down the revolution which, for a number of months, has been raging in that part of the republic.

part of the republic.

The foundation for each of these cars is an ordinary box car of average size. This is sheathed inside with quarter-inch steel plates, a space of two inches being left between the wooden waits and the steel, and filled with sand. The cars are painted in four-inch squares of alternate black and white, and hence received the name of "checkerboard cars."

In each end special portholes are provided for three machine guns, while along the sides are holes for twenty riffee. These holes are made in the black squares, so that, at a distance, it is impossible to see them. Beneath the portholes, inside the car, are benches on which the riffeesen stand to sight their riffee. When mont in mee fer actual fighting, the benches are made into seats for the men by day and beds by night. As are provided in the conter of are provided in the conter of each car, so that the men may live for an indefinite time in their moving fortressee. Protocode water

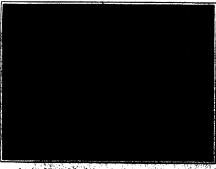
tanks are also provided. One large machine and two small machine guns are planted at each end of each car, with portholes so constructed as to give considerable swing to the mussles of the rapid-dire rifles. Special magazines are provided for cartridges for rifles and machine guns, while the side doors interlock with the ised-linds while so perfectly as to offer no joint for the entrance of a stray bullet from the rifle of an essemy.

To draw these cars, a steel-sheethed engine is being prepared in Maxico city. This engine will be small, but of the regular passenger size in use on most rallroads a few years ago. Not only will the cab, boller, cylinders and other vital parts of this engine be pre-

(Continued on page 418.)



Exterior of the Mexican armored car to be used against the insurrector in the present rebellion.



Interior of the stand threshold me, showing the marking grant and the facilities of which the should become place.

The State of the State of

The Inventor's Department

Simple Patent Law: Patent Office News: Inventions New and Interesting

r Forms of Fuses for

which has to be solved I in designing a thoroughly efficient explosive shell is somewhat complex. It is not enough to merely provide devices which will cause the shell to explode on The shot must be built with safety features which will prevent its premature explosion in transport or otherwise. And these safety appliances must be absolutely reliable, yet simple, if posaible automatic in working, or if they require special setting, this operation must be rapid and straightforward.

Our illustrations show three examples of fuses, which are the subjects of patents recently issued in this country and assigned to the great German Krupp

The first of these, an invention Abendroth (U. S. Patent 988,846) is shown in Fig. 1 of our illustration.

consists of a hollow slightly tanering cylindrical body A, containing within its central cavity a conical boit B in which the primer C (indicated in dotted lines in Fig. 1 I) is lodged. Extending around the periphery of the bolt B is a helical groove, and at the center of the lower face is a recess in which a ball G is lodged when the fuse is not actually in operation. In this transport-position of the fuse the primer boit B ared against forward movement in the fuse body A by means of the two armed latch FF. This latch is pivoted in a recess in the wall of the fuse-body A, and engages with its arm F in notch in the primer bolt. The latch is of such shape that when it is in the withdrawn position (as shown in Fig. 1 (V) all the parts of the latch are out of the path of movement of the bolt B. The weight of the latch is distributed in such a manner about its pivot that the force created by the rotation of the projectile is incapable of withdrawing the

The ball G is held in place by a light leaf-spring H. When the shot is fired, the inertia of the ball G causes it to lag behind, and, overcoming the slight force of the spring A, it passes from the cen-tral recess into the helical groove, pur-suing its path outward and forward the action of the centrifugal force due to the rotation of the shot. Thus the bail finally reaches the latch FF, opens it, and passes out into a recess in the wall, of the fuse, as shown in Fig. 1 IV. The bolt B is now free to move forward se cavity of the fuse, and when imoccurs, the firing pin D' is forced the primer C, whose explosion is

-the primer O, whose explosion is quinticated to the powder body Z aigh the igniting channel B which its existing thereigh the bolt B. is you second figure it, shown a fuse sight by Willer and Schwarz (U. E. at 1986, 1971). The sweet is proposed in the transport-position, segment in the transport-position, segment in the transport-position, segment in the proposition of the transport of the tra

in detail in Fig. 2 II). These are pivoted in such manner that when the fuse is is rapid rotation, they tend to be de-sected outward, clear of the shoulder of shank K. In the transport-position any accidental displacement of the retaining plates F is prevented by a stop D, which is inserted loosely, and falls back by its inserted when the shell is fired. The retaining plates F then swing outward, clearing the path of shank K, and when the shell meets an obstacle this shank is pushed in, levers J open at their rear and through centrifugal action, carriage H is released, and the firing pin is driven into the primer G'.

The two fuses described thus far are designed to operate automatically at impact. The last case here illustrated is an example of a "time fuse," which is set, before firing, to explode after a predetermined lapse of time. The aim of the inventor (U. Wiick, U. S. Patent 988,750) here is to provide a mechanism by which the setting can be effected quickly and easily, without necessity of minute attention to exact manipulation.

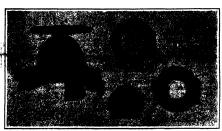
The fuse carries a conical head G an opening in the upper face of the fis

setting the fuse this ring must be turned through a definite angle corresponding to the particular time selected for the fir-ing of the fuse, and the invention illustrated is a key designed for the expres purpose of effecting this setting by a sim ple turn of the hand. The structure of the device is somewhat intricate. A cap C is provided with a handle C^2 and a fiange C. This latter fits into a space provided for it within a housing AA' which also holds an annular ring h above the flange C^i , and another ring Dbeneath that flange. An annular spring F is interposed between C and D, tending to force them apart, and thus press ing flanke C^1 up against ring B purpose of this is to enable the operator. when desired, to rotate the ring B by turning the cap C, the two moving to gether owing to friction and the pressure of spring F. The flange C of cap C is provided at one portion of its inner circumference with a spring latch Co shown in section on the right hand side of Fig 2 I, and in plan in Fig. 3 V This latch has a lug C projecting upward through

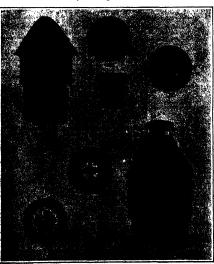
tion of the fuse the shank R is held in (shown in Fig. 3 IV), provided with C, and extending into an annular groove place by the retaining places F (shown a composition ring F notched at F. In B formed in the lower face of ring B, the inner flange of this groove having at one point on its circumference a stop B, shown in Fig 3 V When the fuse base G is inserted into the key, so long as the latch (" does not register with notch F" that latch is forced back, and the stop C is pushed clear of stop B^i , so that cap C^i with latch C^i is free to be rotated past On the other hand, once latch (" has engaged notch F1, stop B2 becomes effective in limiting the advance of the cap C' with its latch C". The ring D is pro vided with a latch D' to register notch G^i on the body of the fuse-head G.

The course of operation in moving the key is as follows. The thumbscrew H is

loosened, thereby releasing ring B from casing A, and allowing it to turn therein freely The handle C is now turned, carrying with it the caps C and by friction also the ring B. until the fiducial mark A_1 (Fig 3 III) lies opposite the desired division of scale B^* which appears on the apper face of ring B, as shown in Fig 3 The effect of this is to place stop B at a definite angular distance from latch D', the ring D with latch D' being held stationary by the wormgear E during the manipulation of cap C just described. The thumbscrew H is now tightened, so to permanently hold ring B in the position which has thus been given it. relative to the housing AA' Any correc tion of the burning length that may be required is made by turning the worm J. The key is now set for a time fuse corresponding to the particular division on the scale Be which has been brought opto the fiducial mark A', and ready to be applied to the fuse-head G Such application will not in general bring either of the latches Co or D' opposite the corresponding notch F or G, but upon rotating the cap in the direction indicated by the arrow in Fig. 3 III and 3 II obviously the latch D' must fall into its notch G' in the fuse base G before one revolution has been completed. As soon as this has taken place the setting member D, the housing AA^1 and the ring Bremain stationary The latch (a must also enter into engagement with the corresponding notch F' during the first rotation of the cap C, and it must do so also tion of the case C, and it must do so also in the case that it has not yet reached its notch F when the latch D enters the notch G. For example the cap C can overcome the friction produced by the spring F between the flange C' of the cap and the flange B' of the ring B and can further be turned relatively to the ring B. the housing AA' and the ring D: furthermore, as long as the latch Co has not entered the notch F', the stop C^* is in such position that it can not hit the stop Bo when the can C is turned relatively to B when the cap U is turned relatively to the ring B. The cap U can not, there-fore, be prematurely fixed in position through abutment of the stops B. CAfter the latch C has entered the notch F the adjustment of ring F commences when the cap is turned farther in the direction indicated above. The turning ment of the cap C is continued until the stop C' hits the stop B', the former reached its effective position relatively to the latter when the latch C relatively to the latter when the latter C^* hits B^* the cap C is prevented from further rotation. The fuse has then obtained the desired adjustment, as the notches G^1 F^1 have now an angular distance from each other corresponding to the angular distance of the latch D' from the stop B^s , which distance was definitely fixed in the setting of the key as de-



Key for setting a time fuse



Two forms of impact from

An Important Patent Decision

Marconi and Marconi's Wireless Tele graph Company, Limited, versus The British Radio Telegraph and Telephone Company, Limited.

This action was brought by Mr. Mar-coni and Marconi's Wireless Tele-graph Company, Limited, to restrain the British Radio Telegraph and Telephone mpany, Limited, from infringing th plaintiff's patent. No. 7.777 of 1900, and two other patents, but at the commence ment of the proceedings it was agreed be tween the parties to confine the present case to the principal patent, as the an paratus covered by the other patents could not be usefully employed without that of the principal patent.

The plaintiffs claimed that the defend ants had manufactured and sold, and were offering for sale, apparatus infring-ing their patent No. 7,777 of 1900, and asked for an injunction, damages, delivery up of infringing apparatus, and

The defendants contended that the had not infringed the patent and that the patent was not valid, and in support of their contention cited numerous docu ments and called no less than seven wit-

In support of their contention of noninfringement the defendants argued that a two-coll transformer was an essential feature of the invention, that they wer using a one-coll or auto-transformer, and that an auto-transformer was not a known equivalent of a transformer at the date of the patent. Further, they argued that if the auto-transformer they were using was an infringement they might instead use a single coil with an equal number of turns in each circuit which would not even be an auto-transformer, and, there fore, could not infringe.

support of their contention of invalidity the defendants relied upon the following patents: No. 8.575 of 1891, granted to Nikola

No. 20,981 of 1896, granted to Nikola

No 11,575 of 1897, granted to Oliver

No 18,644 of 1897, granted to Oliver

No. 29,505 of 1897, granted to Oliver

No. 525 of 1898, granted to Silvanus

No. 1.862 of 1899, granted to Perdinand

No 22,020 of 1899, granted to Ferdi

and Braun

And upon numerous papers and articles Tesla, Oudin, Lodge, Evershed, Fleming, Brown, Fessenden and Blondin, published in the Journal of the Institution of Electrical Engineers, L'Electricien. he Electrician, Proceedings of the Na tional Electric Light Association, Complex Rendus, Electrical World, Electrical riew and Eclairage Electrique The de ndants argued that all these specifications and publications anticipated the patent, and if they did not anticipate it that they deprived it of subject matter

As the case developed the defendants further contended that the patent did not give sufficient directions how the inven-tion was to be carried into effect, and yet at a later stage they endeavored to read all the necessary information into Braun's patept No 1,862 of 1899.

JUDOMENT. (Considerably Abridged.)

Before going into the question of the infringement and validity of patent No. 7.777 of 1900, it will be convenient to say a few words about wireless telegranhy generally and the problems which its practical application has involved, as only in this way can a proper conclu sion be arrived at.

Wireless telegraphy in the sense here of a condenser, and in this respect is Lodge, namely, that you cannot have

entirely different from magnetic industion telegraphy. Moreover, the effect produced on the receiver falls off in the latter case, as the cube of the distance from the transmitter, and in the former ase only as the square of the dist from which it follows that the utilise tion of these disturbances for conveying signals must be far more efficient than

the utilization of lines of magnetic force Henry first noticed that the discharge from a condenser was oscillatory. Kelvin and Helmholtz established the relation between the frequency of the discharge and the resistance, capacity and ind tance of the circuit. Clerk Maxwell showed that the oscillatory discharge of a condenser must give rise to a disturb ance in the ether traveling with the vel ocity of light. Hertz supplied the experi mental verification of Clerk Maxwell' theory, and produced the well-known radiator and resonator, the latter having a minute spark gap. Branly and Lodge produced the coherer, which, substituted for the minute spark gap of Hertz's resonator, made much more sensitive receiver. 1892 Crookes first suggested the utiliza tion of Hertz's waves for wireless telesraphy, and in 1894, the year after Hertz death. Lodge gave his famous lecture on The Work of Hertz." In this lecture Lodge gave a very clear and complete account of the knowledge of Hertzian waves at that date, he pointed out the necessity for a persistent train of waves in order to obtain selectivity, and stated that conspicuous energy of radiation and persistent oscillation were incompatible

In 1896 Marconi applied for his patent No. 12,039 of 1896, which was the first patent ever granted for a system of ether wave telegraphy. It embodied, among a large number of minor improvements, the utilization of an elevated aerial and an earth, but had a number of drawbacks Not only was there the drawback, pointed out by Lodge, that being a good radiator the aerial could not be a good oscillator, but it also suffered from the limitation of capacity and potential of the aerial and therefore of the energy which could ha utilita

-a statement which is true to-day when

we remember that he was referring to

In 1897 Lodge applied for his patent No 11,575 of 1897, in which he em an inductance with a large capacity serial in order to prolong the train of waves and improve selectivity. He thus made a compromise, sacrificing the ra diating in order to improve the oscillating properties of his aerial. In other spects his system resembled Marconi's His aerial was vertical and not horizontal, and he says it may be earthed if desired, and he, too, uses a coherer of metal filings with a mechanical decohering arrangement.

Later, in the same year, L for another patent No. 29 505 of 1897 the following year Silvanus Thompson applied for patent No. 525 of 1898 Both these patents relate to inductive telegraphy, and neither of them throws light on the difficulties incident to utilizing the principle of resonance in a system of telegraphy by ether waves Marconi also applied for patents Nos 12,326 of 1898, 6,892 of 1899, and 25,186

of 1899, all of which refer to the use of a transformer in the receiver for the purpose of increasing the voltage applied to the coherer.

It is true that Braun's patent No 1,862 of 1899 preceded Marc No. 7,777 of 1900, but as there is no evidence that it was put into practice I have now mentioned all that is neces sary for the interpretation of the latter specification.

Marconi commences his specification with the statement that the object of his invention is to increase the efficiency used operates by disturbances in the and to secure selectivity. He obviously ether produced by the sudden discharge refers to the difficulty peinted out by

your circuit doing two in ble, at the same time, and he save in effect: Take two circuits and let one do one of the things and the other do the other. For this purpose he employs a closed osciliating circuit coupled to an open radiating or absorbing circuit and adjusts all four

circuits to have the same time period.

The interpretation I have put on the patent seems to me after careful consideration the true and indeed the only possible interpretation, but before leav ing the subject I must mention the mat of coupling upon which considstress was laid at the trial. It was con tended that loose coupling was ess to success, that no direction as to comis given, and that in one out the nine examples given the counling is very loose. In my opinion the di rection to couple loosely is impliedly if not expressly given in the specification.

It is not disputed that the invention foes get over the difficulties it was designed to meet. It produced a pertrain of waves, increased the available energy, doubled at once the distance of communication, and secured selectivity. The utility of the invention cannot be doubted.

I propose next to consider whether the invention was anticipated by Braun's patent No. 1,862 of 1899. Braun's patent involves many difficulties, and he evidently unacquainted with what Mar-coni and Lodge had already done. The essential feature of Braun's invention the utilization of lower frequencies than he thought were being used, and it is clear that the specification does not con tain even the re motest suggestion of problem which Marconi's patent of 1900 was intended to solve, much less any suggestion bearing on its solution.

That I am right in this conclusion will be further evident when I consider the objection founded on want of subjecmatter. In considering this plea it is important to remember that two circuits in the receiver was no novelty. Lodge had two circuits in his 1897 patent was an engineer of first-rate ability en deavoring to get over the difficulty had himself explained. He had explained. He had two nad himself explained. He had two circuits at his receiving end, and in a way, at his transmitting end also, and yet he failed to see that if he utilized the principle of resonance as between those two circuits the problem would be solved. Marconi had two circuits in his 1898 patent and did not tune them In the transformers of Tesla and Oudin rough tuning was done to overcome the disadvantage of comparatively loose coupling, but this was only with the object of raising the voltage, and is very different thing from deliberately loose coupling and tuning two circuits coupling and together with the object of producing a long train of waves and securing the eceiver and transmitter. In the litera ture quoted there is no trace of the idea lying Marconi's invenion, and no a single suggestion from which a competent engineer could arrive at this idea I hold, therefore, that the plea of wan

of subject matter entirely fails. The only other plea of invalidity is based on the prior grant of Braun's patent No. 22,020 of 1889. This patent is similar to the previous one, with the addition of an earthed aerial. He says nothing or tuning, and the specification contains a passage which in my opinion is inconsistent with the two circuits being intended to be tuned together. cannot see how it can be said that this patent contains a grant of the invention

patent contains a grant of use invention described in Marconi's 1800, patent. Having come to the dismellusion that Marconi's 1900 patent lie a good and valid patent. I must now consider the question of intringement. The defendvant patent, I must now consider the question of infringement. The defend-ants' transmitter contains two circuits, one a closed circuit which is a good conserver of energy and a persistent os-

ciliator, and the other as open at which is a good rediator. These circ are intended to be tuned together contain adjustable devices for that pose. They are also linked together to such a way that the oscillations in the closed circuit will gradually build up closed circuit will gradually build up and maintain in the open circuit IRs cociliations, thus radiating a long train of waves. Similarly, the receiver con-tains two tunable circuits linked to gether. It appears, therefore, that the defendants apparatue contains all the secutial features protected by Marconi's 1900 patent.

It is contended that an auto-transformer such as the defendants are using was not a known equivalent of a trans former at the date of the patent, and further, that they might use an inductive shunt which would not be a transformer at all. I cannot conceive, however, that an electrical engineer, in, say, 1899, would have had any doubt that what could be done by a two-coil air core transformer could also be done by an air core auto-transformer, and this even if arranged one to one, although an inductive shunt had never been used as a transformer before. In my opinion, however, the use of a two-coil instrument is not an essential feature of Marconi's invention at all, and it is a matter of indifference whether a transi

or an auto-transformer be used.

Being of opinion that every claiming clause of Marconi's patent of 1900 is a claim for an entirely novel combination producing an entirely new and useful result, and that the use of a two-coll transformer is no essential part of his invention, I hold that the defendants, who in my opinion have taken all the essential parts of the invention, are infringers, notwithstanding that they have substituted an auto-transformer for a transformer in the combination claimed. and notwithstanding that the use of an auto-transformer with an air core for any such purpose as that for which Marconi has used the transformer may have been new.

The action, therefore, in my opinion, succeeds.

The plaintiffs were granted a certifi-cate of validity of their patent and an injunction, costs and damages against the defendants.

Samuel Loyd

In the death of Samuel Loyd there has passed away an inventor who must ever stand as a type in his peculiar way. To him we owe such puzzles as "Pigs in Clover," "Fifteen Block," "Donkey" and "Get Off the Earth," nearly all of which were sold in enormous quantities. Mr. Loyd was born at Philadelphia seventy years ago. Although he was edu-cated as a civil engineer and was a graduate of Heidelberg, where he studied languages and mathematics, he seems from a very early age to have devoted himself almost entirely to the invention of puzzles. He was only twenty years of age when his famous "Donkey" puzzle or age when his tamous "Jonkey" pursue was invented. This was probably his most successful invention, no less than one billion "Donkey" puzzles having been sold. "Pigs in Clover" was almost equally well known, but did not make quite so much money. Puzzle making with Mr. Loyd was a serious occupation. He is reported to have said: "I always treated and considered puzzles from an sducational standpoint, for the reason that they constitute a species of mental gymnastics which sharpens the wita clears the fog and cobwebs from the brain, and schools the mind to concentrate properly. Comparatively few some know how to think properly. As a school for mechanical ingenuity, for silering up the gray matter in the b M ring up the gray matter in the heath puzzle practice stands unique and sleets "We see how the average boy, will abhors square root or algebra, will find delight in working out puzzles which

of Monthally the same principles. est atadenia who would really have i to learn have been abandoned as gible blockheads because those not know how to interest them in their studies. An aversion to figures and a desire to forget all about mathematics desire to forget, all about mathematics as soon as he leaves school is almost universal, and yet if the subject had been taught in a more congenial way the mathematical and inventive bumps might have developed in a way to aston-

al 24, 1911

ish the family phrenologist."

Mr. Loyd took his greatest delight in working out a puzzle from its scientific basis and then so concealing its foundation as to make it imperceptible to the public.

Hundreds of chess problems were turned out by Sam Loyd, whose first prize for a maker of these was taken when he was eleven years old. He was the author of "Chess Strategy," one of the most popular works on the game. Turning to the mechanical field, he ined such puzzles as the chair puzzle and the star puzzle, almost impossible of solution.

Mr. Lord was for some years chees editor of the SCIENTIFIC AMERICAN. He was tall, rather spare, and had very quiet manners. At the time of his death he was puzzle editor of the Woman's Companion.

Notes for Inventors

Henry W. Johnson.—Henry W. John-on died on April 7th in Lynn, Mass., at the age of seventy-one. He is said to have been the inventor of the shoe button now everywhere in use

"Babbitting." - The name of Babbitt is generally associated with the anti-friction metal which bears his name, but his greatest invention was not the "babbitt metal," but the accompanying process of using such a metal for the bearings of machines, or "bab-bitting." This process has had the widbitting." This process has had the wid-est influence on the development of highspeed machinery Isaac Babbitt was an American, born in Taunton, Mass., July 26th, 1799, died May 26th, 1862 As a boy he was apprenticed to the goldsmiths trade. In 1824 he founded the manufacture of britannia ware in the United States In 1839 he discovered "babbitt" metal. The proportion of babbitted bearings used to-day compared with all other forms is something we cannot know, but It must be so great as to make the num-ber of the others comparatively insignificant

A Westinghouse Ship Brake, -Mr. George Westinghouse, the inventor of the air brake is credited with the invention of a brake for ships acting in connection with turbine engines and utilising a notor which serves to throw the forward thrusting propeller out of operation and to bring into operation a propeller or propellers which give a strong, backward impulse to the vessel. Thus the means causing the forward movement are thrown out of operation and means initiating a regressed movement are brought into play at practically the same time

Patents and the Department of Acri culture.—At one time the Bureau of Agriculture was a branch of the Patent Office under the charge of the Commis sioner of Patents, who reported to Conments of the operations of this branch of his office, including the exfor agricultural purposes. Although the Patent Office has advanced and developed in a way gratifying to even its warmest advocates, it still retains its bureau cratic character, while the agricultural h has grown into an independent department of the Government with a

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throughout the North and East as con think that millions of handwriting expert and figured in many spaceties who would really have important trials. He was colebrated as an after dinner speaker, and on one oc fible Blockheads because those casion, remarking of the wonders of d charge of their education did Shakespeare, asserted that in the writings of the bard you would find a reference to the modern bicycle, and in supporting the assertion, said, "You will remember where in Scene 1 of Act II of the "Tempest,' Antonio says to Alonso, 'We, too my lord, will guard your person, while you take your rest, and

Legal Notes

safety."

Early Patent Appeals .-- Old patent prac titioners recall the period along about 1870 and for six or seven years prior to that time, when appeals from the decisions of the Commissioner of Patents were taken to the individual judges of the Supreme Court of the District of Columbia, including Justices Carter, Fisher, Wylie and Olin. The appellant could take the appeal to any judge he chose, and the appeals were argued in chambers, sometimes at night and sometimes at the residence of the judge. It is said that the appeal fee was payable

trade-mark registration by an act removing the prohibition against the registration of a mark because it is the name of the applicant or a portion thereof. Heretofore if a corporation whose name, for instance, was "The Acme Shoe Co," for instance, was sought to register the word "Acme" as a trade-mark, the application would be refused on the ground that the mark sought to be registered was a part of the name of the applicant. Congress has remedied this in an act approved February 18th, 1911, which contains a provision that nothing in the act "shall prevent the registration of a trade-mark otherwise registrable because of its being the name of the applicant or a portion thereof

The Rear Axle Patent.—A suit has been entered in the United States Cir-cuit Court for the District of Indiana by Thomas J. Lindsay and Willard Har mon against the Cadillac Automobile Company for alleged infringement of patents held by Lindsay on rear axle construction for motor cars The pat-ents all cover a revoluble spring seating on an axle housing, and also a method of loading axle construction whereby the drive-shafts of the axles may be withdrawn without disconnecting the axle housing from the car body, and so the differential may be removed without disconnecting the body from the axle hous-Five years ago suit was brought against the National Motor Vehicle Company, of Indianapolis, for infringement of the same patents. The case is still in court, and no decision has been hardorad

A Skirt Decis cision of the United States Court of Appeals for the Third Circuit, the Feuchtwanger patent, No. 662,714, for a skirt consisting of three parts, was held to disclose natentable novelty and in-The skirt consists of vention. three parts, the lower part being of non-elastic material (jersey), the hip portion of a material having some elasticity, and the waistband of still more elastic matewaisteand of still more elastic mate-rial. It is argued that the skirt was a mere aggregation, but the Court held that the improvement was made in a long-developed art in which there was meager sphere for invention. While jersey had been used in jackets and sweaters, it did not occur to anyone before Feuchtwanger to use it, or any The before and the Bicrois.—The before Fouchtwanger to use it, or any to the E. B. Hay was well known expansive material, as a section of skirt.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The offices are inserted by special arrangement this the inventors. Terms on application to the dvertising Department of the Scientific

Electrical Devices.

RECRIFICE AGAING.—LOUIS FYEINBROER,
Brooklyn, N. Y. A receiver casing for telephones constructed according to this invention
is much stronger than those usually employed
it cannot roil off of a deak or other surface
upon which it may rest, and is not liable
to linjury of destruction from jarring or knock
ing due to the swinging of the receiver and
the striking of the same against adjuling sar-

MODTHPIKCE .-d.o.us STRINGERGE, Brook-lyn, N. Y. The invention relates to mouth-pieces, and especially to those of the kind used for telephones, and by the sid whereof sounds are to be throm upon all shiptrage, the most particular purpose being to improve the acoustical properties of the structure, and also to render the mouthpiece more sanitary.

Of Interest to Farmers.

Of MILE PURIFYING AND HOMOGENIZING ter, MACHINE...-II. II Synary, Slour City, Iowa. and The object of the invention is to provide a mahe, chine, by means of which milk can be randered stable, and insenditive to acuting causes, by means of which impurities can be removed from the abils, and in which the globules of the manufacture of the milk and the substitution of the milk and the

is said that the appeal res was supable directly to the judge sitting in the case, and it is sometimes intimated that frequent is sometimes intimated that frequent reversals of the Commissionaries decisions tended to stimulate appeals in cretain directions. Change in Trade Mark Registration Change in Trade Mark Registration Law.—An important change have recommended to the contribution of the contributio

It to assume an inoperative position POULTARY INNECTICIDE APPLICATOR.—
A. F. BRULER, Accasum, obto This invention provides a reservoir for liquid insecticides, the reservoir baving connected therewith a wick or other transferring device for spreading on the head or body of positive or animals the liquid; and profiles a reservoir clongated to ever the maximum space, and having supporting means therefore, whereby the reservoir may be placed in position to discontinue the old delivered theorems.

SANITARY CUSPIDOR -- Jozape Panola.

142 East 19th Street, New York, N. Y. This invention includes a receptacle or cashin which is mounted a glass tray, which is operated by a handle-like actuating desires as to be turned down or up into position.



SANITARY CUSPIDOR

to permit the contents of the tray to be washed away by the floshes of water by raising and lowering the handle. Thus the couplior is thereoff the tray of the tra to permit the co

pipe. This patent is No 198,004 and is for sake Terms oliticalizable at above address and the sake Terms oliticalizable at above address and the sake Terms oliticalizable at above address and the sake the sake and the sake and

are devised which combine maximum lightness, atrength and rigidity; and a spud is provided with a pneumatic attachment, which greatly facilitative the operation of hoisting the same out of the mud

the same out of the mail

TRIPLE PURIFICATION WATER STILL.

TRIPLE PURIFICATION WATER STILL.

TRIPLE PURIFICATION WATER STILL.

TRIPLE PURIFICATION WATER STILL.

TRIPLE PURIFICATION WATER STILL STIL

a comparatively low cost

LIMB RENT—H RUBBERGEN, Shawano,
Wis This favorition is an improvement for
tests, particularly such as are used for supporting an arm or log of a coupse during
the precess of embaining, and has in view
an appliance of this nature adapted to be
destrabally and rimaly cianopet at the edge of
a table or cooling hostid, and adjustative held
at the regular elevation and point of use

at the required elevation and point of use.

RHEET METAL PRIME. W P LAWRINGE,

Colorado Sigrings, Colo. The improvement is
more especially in such frames as are designed

to contain glasse panels, such as mitrors, windown, doors, pictures, etc. and has in view

a frame which acts to iterally retain the glasse

without the use of numerous screen, putty,

results, removeble and paint ende, whereby

the renewal of the glasse requires but little

work or skill

METHOD OF OBTAINING SOLUTIONS ON

the releval of the gass requires not fitte with the control of the control of the control of the QUAST ROLLTIONS OF CERTAIN ME-TALLIC OXIDS -2. Cars waters; Hierd, he-sex, begind This application relates to a method of obtaining solutions or quast solutions of units of metals contained in the iron group, via iron, manganes and chromism, of the control of the control of the con-chemically indifferent to the called according to the method forming the subject of the present application, the metallic sakes are suspended in an aqueous solution of a sepona-ceous material, and thereafter precipitated by EMPLICATIONS INLY SURFERN J. E. Mos.

the addition of an acid FORDERIOVEN RAY SCIEEN J K Hot-moon, Newark, N J An object here is to provide a device which will refund those rays which act on the sensitized plate or fling quick-cit, and thereby obtain a photograph in which the detail throughout will be just right. The invention has reference to foreground ray screens for use of cameras on other picture-taling derives.

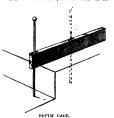
taking devices

NNITTARY VACUUM CHIF REMOVER—

L. S. Bouxsa, Oakland, Cal. This improvement pertains to a sunitary resume chip resource to be used in dentista for removing and after detting with a detail bur An object of the invention is to provide a remove with many to operated by either compressed air or water, which comes a suction through the apparatus.

Hardware and Tools.

Hardware and Tools,
DEPTH GAME—Javon STRIARS, 624 East
Jersey Street Blandelt, N. J. In the gage
Illustrated herewith, in champing either of the
blades in adjusted position in either of the
keepers, the every is adjusted so that its end
adjacent to the blade will hear thereagainst
in transferring the blade to the other keeper
it is only meessary to lower the serve, to
descage the blade in the the blade in the

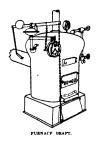


HAMB FASTENER—J. G. Orman, Malletts, 8, 10. The Invention has in view a relatively atrong, compand fasteror which is result; mellenging the second of the visit operate to hold the hame virap close to the coliar, it is further constructed so as to be sailly applied to hame of the customary type.

applied to hames of the customary type.

COMINING SQUARE AND RULE.—P. B.
OATS, FORT TOWOOD, Ohla. An object in this
instance is the provision of a device barding
a rule portion, and a square portion adapted
to extend at an angle to the rule portion
when the parts are in their extended position,
and to be collapsed parallel to the rule portion
when the parts are in their citeded position,
when the parts are in their folded position,

Figura and Lighting.
FURNACE DRAFT OPERATING APPARATUS.—W. H. SOURBER, dill Carpeter
Avenue, New York, N. Y. The engraving
bolice, for opening or clothen, at any horse
desired, the fentus of a bolice or other heating plant. In addition to swing of labor and
the suvety of a countraible house the first
thing in the morning, economy in fuel con-



sumption is also claimed The short chain held by the latch on the clock holds down the forward end of the automatic regulating bar, thus keeping the deaft and chimney damper closed until such time as the clock has been set to operate the latch. When the latch re-lease the chain montioned, the weight on the bar named causes the drafts to be opened. In the control of the control o

Household Utilities.

Household Utilities.

ELECTRICALLY HEARED OVEN.—F. J. Coor, Collinwood, Ohio. The Invention relates to overa, the more particular purpose being more best-redicting also made of store and expecially adapted for receiving and holding the heating wire. It is used for baking, warning and emmillier; also in connection with pinnake griddies, broilers, toasters, chaffing dishes and hot plates.

Machines and Nechanical Devices, PAPER PERDING MEGRANISM—T. E. Honozinson, 3 Roseberry Avenue. Clerken-weil, London, Magiand. This invention raises to mechanism for privileg folding or the like machines, and more particularly to the type machines, and more particularly to the type of the machines, and more particularly to the type of arms secured at one end to a Shaft and provided at the other end with a fretional pad, so that when the shaft is rotated the pad is brought down on the plie of paper sheets to be fed with more or less force and the sheets are fed to the shaft and the sheets are fed to the shaft and the sheets are fed with the shaft and the

fed forward one at a time.

ROTARY PUMP.—A. FOURNIES, Sprague,
Wash In this patient the inventor's object
is the provision of a new and improved rotary
pump, designed for pumping purposes and arranged to utilise the driving power to the
fullest advantace, with a view to produce a
continuous and a forceful stream.

continuous and a foreful stream.

APPARATUS FOR MOLDING BOTTLES.—

H. O. Bissana and W. L. Boor, Coshocton,
Ohio. This invention provides a machine with
a revoluble modding table having a series of
modds thereon; provides a reciprocetting bead
having mometed thereon a blowing pips and a
parting model for shaping the necks of bottley;
and provides means for electing and depresfing the reciprociting head.

ing the reciprocating lead.

POWER TANENISSION MECHANISM.—

B. S. MORROW and C. M. SHIMONS, ("extor, Okia. This invanition relates to automobiles and other power-driven vehicles, and its object is to provide a new and improved power transmission mechanism, more especially designed for driving the front axis, to cause the troot wheel to pull when traveling in a strught line or on a curve.

STREET HIS OF OR A CHIPS.

ARROPLANE PROPELLER.—C. M. WANARR, Urbana, Ohlo. This investion provides
means for reinforcing and mustually supporting
the blades; provides a reinforcing structure
disposed in straight line arrangement, whereby

tensile strength of reladorship members is utilised; provides means for presenting when-tion in the orders of the relativistic strength of the provides for each of the relativistic strength and provides for self-size strength of the most. It is an improvement on propellers now in use, as they are not capable of giring sufficient impulse at the moment of starting or of applying sufficient power while in flight, as they have not complet was gerable.

as they have not enough wing swelface.

INSTRUMENT FOR USES IN KNYIGATION.

—O. B. SAYDERS, Key Week, Fig. By the use of this device the true occurs in the shortest posterior of the device of the de

Prime Movers and Their Accessories.

ROTARY INSIGNE.—W. H. RICHMOND, Macquetta, Mich. An object of this tremeter is
the provision of a new and improved engine,
arranged to utilise the motire agent to the
fullest advantage, by giving the piston an
initial impulse by the abstance and a second
impulse by the direct pressure of the motire
agent.

EXPLOSIVE ENGINE—CHARLES E. Good-sich, Deggett, Cal. The invention shown herwith provides a double oscillating pision, producing a continuous reciprocating of a pitman and a rocking shaft connected ther-with, provides a pitrality of explosion cham-bers, each operable from both ends thereof bers, each operable from both ends thereof explosive type radially disposed about a



rotary driving shaft having a flywheel to conform to size of said wheel, provides a shaft with a flywheel, the schopp is first shaft with a flywheel, the schopp is first sep-arated to provide holding spiess for valve-mountings and operating mechanism; and pro-vides a multiple explosion motor about the driving shaft with oscillated pieshes and trans-lating mechanism for converting redprocated in the state of the state of the state of the shaft. haft.

allways and Their Ac-

Ballways and Their Accessories.
THAIN PIPE COUPLING.—1. W. Moss and C. E. OLGUINES. Beaumont, Toras. The aim in this improvement is to provide a simple coupling by means of which the pipes may be expeditiously coupled and uncoupled, and which will make a tight and secure Joint, that will be unsferred by the relative displacement of the cars with respect to each other incident to ordinary travel.

GCAID RAIL CLAMP.—1. Q. Woozn, New York, N. I. in this case the object is to present the guard rail at all times in preper position one relative to the other, and without danger of the rails spreading spart, the champ bulgs simple and arranged to permit of conveniently piacing it in position.

Pertaining to Vehicles,

Ferrialming to Vehicles,
STEAM BOILER — J. J. PHEREN, Richfeld,
and H. Dersson, Manti, Utah. This invention relates be steam traction engines and
to relates be steam traction engines and
belief arranged to insure at all times proper
delivery of dry steam to the engine whistle
or other device, and freespective of whether
the boiler is on the level or inclined in either
direction on the vehicle going up or down
a bill.

HEW MOOKS, MIC.

ANY OF Carine Managerary, 137 Francis L. Wellman, New York: The Macmillan Company, 1916. 484 39. Price net, \$2.50.

of parts all conserved and account of the particular of postalities.

The Geology of Buildings Sporter.

Allen. Howe, B.Sc., F.G.S. New J. G. In State of the particular of the second trial.

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Allen. Howe, B.Sc., F.G.S. New J. G. In State of the particular of the second trial.

The Geology of Buildings Sporter.

By J. Allen. Howe, B.Sc., F.G.S. New J. G. In State of the particular of the second trial.

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STEAM SOLUER — I. Juranu, Richindid, and H. Durinoy, Manti, Utah. This invess and H. Durinoy, Manti, Utah. This invess and thou relates to seam traction engines and a Suppose of the State of the State

The state of the s





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MISCEL LANGOUS.

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ally reliable information given in regard to operate in fourthern Oranos, and mining prop-mined and correctly reported op. F. Tomes, Geologies and Constilling history inclines:

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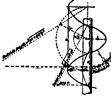
EMAD THE COLUMN CARBSTULLY.—Toe will find epitrics for corrules change of criticism numbered in accounting office. If you manufacture these modes rich in an excess and we will send you the name and them not be party dustines the information. There is the party dustines the information of the party dustines are in the party

Notes and Queries.

Kindly keep your curries on separate absets of paper when corresponding about such maties as patents; subscription, books, etc. This will greatly facilitate answering your questroid to expect the control of the contr

J. M. J. Your attention is called to the statement regularly printed at the head of our Query column, "No attention is paid to unsigned queries."

(12486) J. M. W. says: I wish to 1(1248) J. M. W. says: I wish to work a spiral cut of tit, the planes of which are to be 0 or 8 inches wide, wound round a k,-linch cylinder; the turns of the spiral to be 4 or 6 inches apart. Will you pleas tell me how to do this? A. You need to know the blacks of the black is the plane of the house of the black. Let do be the intole radius and 5 the outside radius of the plane. Let do be the intole radius and 5 the outside radius of the plane. The first of the high the plane is the plane in the plane. The plane is the plane is the plane is the plane in the plane is the plane in the plane is the plane in the plane. The plane is the plane is the plane is the plane in the plane. The plane is the plane is the plane is the plane in the plane is the plane is the plane is the plane in the plane is the plane is the plane in the plane is the plane in the plane is the plane is the plane is the plane is the plane in the plane is the pl $\sqrt{p^2+40}$ b. If W is the width of the biade, b—s=W. Now the segment of sheet metal which makes the blade must have radii longer than those of finished spiral, so that it will



parl up" close around the shaft when pulled to the desired shape. Let X and F be the

Then $\frac{X}{Y} = \frac{\sqrt{p^2 + 40 \text{ d}^2}}{\sqrt{p^2 + 40 \text{ b}^2}}$ before, Y = W + X, and

√p2 + 40 g2 √ p³ + 40 b³ w + x

w+x νρ²+40²β
you know a, the Insider radius of the shaft on which the spiral is wound, which you say to be ¼ inch, and p, the pitch of the spiral, which you say is to be 4 inches to 0 inclus, and you know W, which is to be 6 inches to 8 inches. Decide what exact figures you want, would be with the which will give you the radius you want.

Note that \$3.547 = 0.668.

Note that $3.14^{\circ} = 10$ (very nearly) and that the outside curve of the piece of metal which will be curled up to form the helix or spiral

the cutside curve of the piece of metal which will be caviled up to form the halis or spiral is squal in length to the line $\sqrt{y^2 + 40^2} \text{ M}^2$ which is the cutside of spiral wershied; the way which is the cutside of spiral wershied. The same ratio cache of the as $\sqrt{y^2 + 40^2} \text{ M}^2$, and their radii X and T have the same ratio, while V = X + V. (1467) J. B. F. says. The star Versan which such about 7 P. M. seems to have a distinct oscillating or "feating" motion which has been commended upon by a great many of the daily papers. A. The scintilization ammono, but in notioned when the planet is near the sua in the sarry everlight, and when the atmospher is much disturbed. On clear cold winter alphase that the bright stars many had many letters from the foots the doct this matter this winter. Some have declared that the planet was a new star moving so registly about that it let a trail of sparse bookind it as it went.

it won't (1243) C. C. says: Will you please and me copy of your paper which tells how the rechange for patteries, as it seemsthe seeing it in one of them? A. You will find in Suprementary 1368 and 1361, pide tan cost such, rall details for making day cells. There is no good way to prekarge old dry cells. They are not worth the labor and cost, but are universally thrown into the weath ham, form have get a little more service out than by cell that a per of this or beginning the latting cell into a for of ditties employed and, or better of an ammonion unitation. Such out must fellow a company of the control of the co passage tee of mi sminoniae schulden. Shash cell most share no separate jar, then making the betterp me sedinary seet betterp. Others have get a stille like by digging out the joint from the cap and making the cell in a uni interesting the cell in the cap and making the cell in a uni interesting the cell in the cap and making the cell in a uni interesting the cap and making the cell in a uni interesting the cap and making the cell in a unit interesting the cell in the c

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Saiing from Hamburg during June, July and August on large twin serve stammings Buncher, Cincinnati, Kronprinnenin Cellis and Beteren. These trips include Nerway, Spitzhergen, North Cape, Scetland, Icoland, Orkney and Farue Lides, and the Northern Sensité Resorts of Europe. Duration 13 to 24 days. Rates \$62.50 upwards.

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jumped to 30,300,000—because of this tire's popularity.

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making. It tells you how to cut to the minimum this item of upkeep cost. Write for it.

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All climatic conditions look able to the man
who uses an Elbridge M More in his encopleme
More prediction and the second of the second



I H C GASOLINE ENGINES PAY BIGGEST DIVIDENDS

mands of owners know of their simpling, reliability, strength, and durable, and durable south of their simple south of their south of the south of their south of their south of their south one. Write at once for the 1 cataiogne. Read of the many siy is 1 to 4 horse power, all or water on carry or portable and traction. Read of the many six of portable and traction. Read of the many six of portable and traction. or water cooled and traction. Head what a deamtages there are in the engine that your requirements best from the decide till read the I H C established. Now is a good to write a postal. Simply address markens I water the second cooled to write a postal.





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Battleship versus Destroyer

Hartischilp verums Destroyer
(Continued from page Met.)
pany. The tests of this weapon have
shown it to possess slightly greater accuracy and far greater penetrating power
at distant ranges than the present 12inch gun. The weight of the shell has
gone up from 850 pounds in the 12-inch to nearly 1,400 pounds in the 14-iach, and though the muzzle velocity is less, the muzzle energy is far greater, and the falling off in the energy at long range is

failing off in the energy at long range is very much less introduction of this gun means in the "New York" and "Texes" will be understood when we state that its projectile will be capable of penetrat-ing the armor of any battleship afoat at any range at which the hulls of the stream are stable. Moreover, to such a ships are visible. Moreover, to such a high pitch of accuracy has gunnery been carried in our navy that at these extreme ranges the majority of the shots will get

ranges the majority of the shots will get home.

In clear weather the torpedo battle-ship, then, will be under fire at a range of nine miles. Its speed of, say, 24 knots, would enable it to get within torpedo range in a rounting fight within a couple of the ships o

about 2.850 tons; coal and fuel oil carried on trial, 2.157 tons; apeed on trial minimum, 21 knots. The armament will consist of ten 1-4-inch, 45-caliber riffes and four submerged torpedo tubes in the main battery, and in the secondary battery twenty-one 5-inch rapid-fire guns; there will also be four 3-bounder guns for saluting, two 1-pounder guns for botat, two 2-inch field pieces, and two 30-caliber machine guns. The armor plan has not been published, but it will be unusually complete. The ships are to be finished in about thirty-three months from the present date.

A DESTROYER OF BATTLESHIP SIZE BY B. G SKERRETT.

At the close of the war between Russia and Japan the technical press was sitted with the technical press was sitted to be to predo the technical press was sitted to be to predo the technical press of widely varied effectiveness—in some cases the damage was undoubtedly disastrous, while in others the amount of injury was asonishingly small. The different ranges at which the torpedoes were fired and the manner in which they struck their targets had much to do with the results, just as we should expect of struck their targets had much to do with the results, just as we should expect of any projectile fired from a gun; and we must not forget that the torpedo, in any projectile fired from a gun; and we must not forget that the torpedo, in a sense, is also a projectile, and cannot be expected to function uniformly under all possible circumstances of service. However, or dispoil some of the doubte for the control of the termine at first hand some of these questions by means of experimental firings against one of her old battleships. For this service the "Francesco Morosini" was especially prepared at considerable expense, special cofferdams being arranged expense, special cofferdams being arranged damage of him the areas of possible damage at him the areas of possible damage and the special conferdam being arranged damage of the special conferdam s

easily explaining the prompine which the vessel sank, was a gr price to the officials.

which the vesses such, was a great mapprise to the officials.

Immediately after the "Magnesian" that it was authoritatively gamouneed by Sofia the Austrian and the British technical press that the direct result of the experiment would be his introduction of the state of the experiment would be to proped is madeling tubes—the craft to carry many more of these than any other ship either any more of these than any other ship either ship in the same of the state of the st

ing fiset of the immediate future.

During the past ten years experimental work has revolutionized the military efficiency of the automobile torpedo; the weapon is now capable of carrying a larger destructive charge and is able to run farther and to hold its course with a remarkable degree of precision and speed. While the modern battleship may survive the blow of a single torpedo, still enough damage would, in all likelihood enough damage would, in all likelihood, result to render the ship incapable of holding her position in the line or maintaining the fight under conditions of equal efficiency. Should the torpede explode under either the bolies or magazine spaces, one blow might be enough either to destroy the ship or to render her completely hors de combat. No single shot from the biggest of modern guns could record these same vitals under normal to the destructive superiority of the torpedo.

Rear-Admiral R. H. B. Bacon of the

bedo.

Rear-Admiral H. H. S. Bacon of the British Navy has said that the battleship of the further well be designed exclusively for combating other battleships, and that intermediate heavy craft would disappear and the link between the ocean-going destroyer and the battleship would become closer—the ses-going torpedo craft acting as definative and offensive saichlites for present no existing torpedo craft are capable of truly fulfilling Admiral Bacon's prophecy; none of these vessels is big enough to take the sea and to hold her own with the battleship under those

big enough to take the sea and to hold ther own with the battleship under those more trying conditions of wind and sea in which the modern dreadnought is capable of calling an enemy to account. Everyone knows that the battleship is merely a mobile, armored platform for the proper carriage and transport of the heavy ordinance which constitutes its prime means of oftense. The biggest of our 12-inch rifes at present affect fires or of the weight for order to accomplish its purpose, the armorp-incring shell must perforate the defensive plate and remain intact, so defensive plate and remain intact, so that it may burst with maximum vio-lence after it has passed through the protecting armor. The modern automolence after it has passed through the protecting armor. The modern automobile torpedo has a bursting charge of gun-cotton of more than 200 pounds in weight, and this explosive, per unit of weight, is several times more destructively violent when properly detonated than the explosive or bursting charge with which our armor-piserding projecting with which our armor-piserding projecting the action of the torpedo in the Russolanguages war, Italy underfook to detarmine at first hand some of these quetions by means of experimental firings
against one of her old battleships. For
this service the "Francesco Morosini"
was especially prepared at considerable
repairs against one of her old battleships. For
this service the "Francesco Morosini"
was especially prepared at considerable
repairs against one of her old battleships. For
this service the "Francesco Morosini"
in fact, in the very region of the ship's
was especially prepared at considerable
repairs and yet up to now the torpedo
and any the state of the ship's
developments capable of further minimining the destructive powers of the
torpedo in order to carry out the simjustion of actual attack as far as possible, a regular service torpedo was held
against the side of the ship by means
of a framework fastened about three
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e Polyteciale Indi

to to speak, in the face of a storm of respid-fire projectiles, until within certain striking distance of her quarry. The vessel herewith shown is amply assured striking distance of her quarry. The wessel harewith shown is amply assured of this power of resistance, because her waterline and broadside throughout the greater part of her midship length are shielded by armor plate ranging from six to twelve inches in thekness, while the waterline region forward and abatt of this area is also covered with protecting armor and celliones, so as to asteguard the ship against attack which might impair her skilling. In addition to this country and the ship against attack which might impair her skilling. The skilling is the country water body is defended by a double bottom, athwarfaith builkness of heavy under-water body is defended by a double bottom, athwartable bulkheads of heavy plating, and also light vertical and hori-sontal armor plating throughout the ra-gion of the torpedo tubes, and the boiler and engine spaces, as indicated in the and engine spaces, as indicated in the law of the state of the space of the space is something of a departure, and is pur-posely designed to render this vessel less vulnerable to the attack of other torpedo craft.

oraft.
The proposed ship has the following principal characteristies and general dimensions: Displacement, 15,250 tons: length over all, 425 feet; maximum beam-75.5 feet; draft, 25.5 feet; motive power, turbines, total capacity 35,000 indicated horse-power; speed, per hour, 24 knots; radius of action, at 18 knots per hour, 24 knots; radius of action, at 18 knots per hour. ,000 knots.

The armament is to consist of the fol-

The armament is to consist of the following elements: Thirty under-water torrysdo tubes for the discharge of the long 18-inch Whitchead torpodoes; twenty 4.7-inch quick-firing guns in individual turrets; two 47-inch quick-firing guns in casemates, forward on, the main deck; ten 2.56-inch quick-firing guns, distributed forward and aft on the bridges.

The ship will carre a supply of six? The ship will carre a supply of six? Carrett of the content of the

security while the ship is actually at-tacking the enemy, if it be necessary. Certainly a ship of this sort opens up a new and fescinating vista in the evo-lution of the fighting craft.

The Gordon Bennett International Aviation Trophy (Continued from page 107.)

elimination race will no doubt be of in-terest at this time.

The wonderful French production, the

The wonderful Prench production, the Gnome rotating motor, will undoubtedly be used, to the exclusion of all other makes, by the French team. Whether this motor has the qualities of endurance possessed by the older reciprocating engine is a matter open to discussion; but the performances of the past season have shown pretty conclusively that as a raching motor the Gnome is in a class by itself. It holds all of the worlds aviable of the contraction of the contract of the con

aggine used in what we might call the touring servolane, while only a very limited number of the 100 horse-power type have been made, and these were used only for racing purposes. The 100 horse-power motor is practically two 50 horse-power enders in tandson, a common Power motor is practically two 50 horse-power engines in tandson, a common Power and the same and the same and the same as in the previous models, the same as in the previous models, the same as in the previous models the same as in the previous models the same as in the previous models the same as in the previous models, the same power being obtained by enlarging the box. Such as the previous models are the previous models, the same power being obtained by enlarging the box. All the same than the same than the same than the same than the previous models and the previous models and the same than the same transition of the operation of the same than than the same tha

that used by Henry Fabre in the biplane bearing Paulhan's name.

The entering wedge of the wings is quite different from that formerly employed by Blériot, and, indeed, unlike ployed by Bieriot, and, indeed, uniter that of any other machine. Monoplane makers up to the present time have followed pretty closely what is techosely what is tech-"Phillips section" in nically called the onstruction of their wings, as shown in Fig. 1.

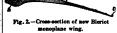
Biériot, in his new "fish tail" mono-

Fig. 1.-Phillips section curve generally

plane, has made a radical departure from the orthodox design, the entering wedge having a decided and peculiarly wedge having a decided and peculiarly radius and the second of the state of the wings and that portion up to b in Fig. 2 is rigid, except for the slight movement allowed for "warping." From b to c there are tapering flexible ribs sunk into the rigid portion of the wings, and separated from each other by a distance of about one foot. The whole framework is covered, as is customary, with cloth, the cloth stretched between the flexible ribs giving the wings a bat-like appearance.

flexible ribs giving the wings a bat-like appearance.

The "fuselage," or body of the "Model Twenty" Bleriot, is, unlike the former types, entirely inclosed, cloth being tightly laced over a framework similar to, but about half the depth of, the standard



seculiar blunt shape of the heavy front edge is wn at A, and the flexible rear edge from B to C.

The possible blant shape of the heavy front edge is shown at a, and the faither are eige from B to C.

Bléfriot fuselage. The tall plane and elevator are fait instead of curved, and the rudders are two triangular planes above and below the fait tail plane.

The writer was present at the Blériot school at Pau, France, when the first "Model Twenty" was tested. Driven by a Gnome 50 korse-power motor, it passed the regular model with the same engine at a speed approximately 20 per cent greater. Evidently Blériot himself was pleased with his new design; for the Cordon Bennett, fracer is the "Model power Gnome motor.

Another monoplane which has attracted some attention lately, and will probably be heard from in the French elimination race, is the "Deepedussin," designed by a Frenchman of that name This machine has some points in common with both the Blériot and Antoinette. The "Deepedussin" first came prominently into the limilight when Russon, a couple of months ago, at Chemin broke fanome motors, now being built, is for the "Deepedussin" monoplane intended for the Gordon Bennett elimination.

A machine almost identical with the A machine almost identical with the Blériot in general appearance is the Morane, designed by Leon Morane, a former Blériot pilot of note. The Morane monoplane differs from the Blériot principally in the landing chassis and tall planes. From the above one can see that it should be a factor in the French trails.

Aviation experts were indeed surprised when the little Nieuport monoplane, driven by an opposed double-cylinder motor of only 30 horse-power, practically in the Priesen elimination in the observable of the construction of the present elimination in the observable of the construction of the proposal and the propo

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follows the "stream-line" form more nearly than that of any other machine, being comparatively bunt at the bow and tapering gradually to the tail. It is the opinion of the writer that few designers to-day realize the snormous importance of reducing head wesistance in a racing aeroplane, or, for that matter, in any type of machine of voler.

In speaking of the racing machines which are likely to flurne prominently in

In speaking of the racing machines which are likely to figure prominently in the French trials for the Gordon Bensett trophy, one cannot neglect mentioning the Breguet biplane, which holds the world's record for weight lifting. Only a few weeks ago this remarkable machine few a short distance at Doual, in France, with no less than twelve persons showed and size absent during remarkable. spead, and also showed truly remarkable speed for a biplane It is safe to say that, outside of the Wright "Baby Grand," which has been somewhat of a "dark horse," the Breguet is by far the fastest biplane in the world. And in Breguet the world has another designer who ap-preciates the advantage of keeping down preciates the advantage of keeping down head resistance. In his new biphase most of the wire stays and small struts common to biphanes have been eliminated, and large frame members, of fewer number and having a "stream-line" form, have been substituted The fuse-lage, too, is needed and of small section, also the stay of the freedy large to the stay of It certainly looks, just now, as if the French will be well-nigh invincible in the Gordon Bennett race Unquestion-ably the French lead the world to-day ably the French lead the world to-day in aviation French makers are carefully guarding their new models, and will not place them on the market until after the Gordon Rennett contest. Both England and America will have difficulty in choosing a team of three fast machines to carry their respective colors, while the French have a great variety from which to choose. This fact, combined with the fact that the pick of the new 140 horse-nower Gnome motors will new 140 horse-power Gnome motors will doubtless be assigned to the French racers, gives the French a decided ad-vantage in the forthcoming contest.

Armored Cars in the Mexican

Revolution (Cratinued from page 410.)

teëted, but the steel apron extends down over the drivers and trucks, back over the sides of the water tank, and up afound the smokestack, coming back in a straight line to the cab, so as to pro-tect the domes as well.

The main use of this engine and the

The main use of this engine and the armored cars will be to patrol the Mexican Central branch of the National Railways on that division which extends from the border at Juarez (opposite El Pasco) to Chiunahua, a piece of railroad which has been in the hands of the rebels for some months The government believes that, with these cars, it will be able to prevent further dynamiting of bridges and tearing up of tracks by the insurrectos, at least along this portfeular line.

Lakes Tipped by Winds

U NDER the force of great guies, large lakes and tideless seas, like the Caspian, have been observed to experience surprising changes of level, as if they were huge basins of water tipped by the were huge basins of water tipped by the hand of a giant. In the Caspian a difference of level

In the Caspian a difference of level between the two sides of the sea amounting to twelve feet has been noted during the prevalence of a heavy wind. In Lake Erie a difference of level of fitteen feet has occurred in similar circumstances. Analogous observations have been made on other lakes and in the Baltic Sea.

the many hands are coming among selling only all arches is 12 tons, and on the buttresses old company selling only all tons per square foot.

Four Persons in a Become Cress Country Flight.—That the prophecy ands on page 407 regarding the immediate use of the aeroplane for eron-country Hights with several people, is already being Julified, is shown by the record Hight on the 14th inst. of Aviator Lanser from Klewit to Brussels—a distance of 54 miles—with his three sisters.

miles—with his three sisters.

Aviation at Minecia.—Last week W.
Starling Burgeou made some Sights in a
Wrighttype tiplane of his own construction, at Minecia. He has bearned to fly
a Wright machine and is manufacturing
them under Heense, as well as Farmantype biplanes, of which he has already made seven for Grahame-White, Mr. But gess has opened an aviation school a Mineola, and a number of pupils have a ready been enrolled.

ready been enrolled.

Unsuccessful Test of a Novel Assoplane.—The first test of the novel dishshaped asroplane of W. S. Romme, the
model of which showed accellent automatic stability, occurred on April 14th
at Sha Antonio, Texas. Although fitted
with a Chome motor of 50 horse-power,
the machine was unable to get off the
ground, according to the telegraphic raport. It is add to have been tather badly
damaged by joiting over the ground. Mr.
Harold McCormick, of Chicago, has asisted in the developing of this machine.
A Navel Two-motor Asroplane.—One of A.
A Navel Two-motor Asroplane.—One of

A Novel Two-motor Aeroplane. -One of the would-be entrants for the Gould twothe would-be entrants for the could two motor aeroplane prise is Mr. Julius W. Schubert, a young Austrian of considers and able mechanical shillty, who has invented and and patented a novel biplane and motor with a view to competing. The usual de-vices for maintaining the transverse balance of the aeroplane are dispansed with in this biplane, two double-surface hority cantal ruiders—one towers seek sides. zontal rudders-one toward each and in front-being used instead. ch side motor is in three units, two of which are run together and made to drive two pro-pellers in front, while the other unit drives a single propeller at the rear. Mr Schubert would like to hear from any one willing to help him in the construc-tion of a machine with which to compete for the Gould prize.

for the Gould prise.

Perlious Flight with a Lady Passenger in America.—Frank Coffyn, one of the Wright valators, made a 17 mile flight from Augusta to Alken, S. C., in 21 taintuse on March 20th. He was accompanied by his wife, who was thus the first lady passenger to make a cross-country flight of any considerable distance in the United States This flight was made in a strong wind. It was an excellent demonstration of the airrady well-known capabilities of the Wright machine. The speed average was about 60 miles an hour.

An Asteniblem Flight from London

An Astonishing Flight from London to Paris.—Not since the late John B Moisant flew from Paris to London with Moisant flow from Paris to London with a Dessenger has anything so sensational been accomplished in this direction as was the non-stop light of M. Pierre Prier on Thursday, April 6th. In a Bildriot monoplane of 50 horse-power, M. Prier covered the distance of about 250 miles in 258 minutes, or in less than four hours, thus averaging more than 63 miles an hour throughout the entire distance. The start was made from Hendon, near was at Isay be Moulineaux at 5, 33. Both at the start and at the fluish the aviator ran into a thick fog and he was obliged to ascend to the height of 3,200 feet in order to get above it. He crossed the Channel at this height, which he Lept throughout most of his journey. At Channel at this height, which ne kept throughout most of his journey. At Beauvais, about 50 miles from Paris, he entered the fog a second time, after hav-ing a clear atmosphere during the interon other lakes and in the Baitic Sea.

In a constant of Battressed Archa—A torse of dam with buttressed Archa—A torse in pace of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of a ravity mass is outlined in a size of the same of a ravity mass is outlined in a size of the same of a ravity mass is outlined in a size of the same of a ravity in thickness from 17 feet at the ravit for ravitined and or ravity of the same distance arous countravan, with their abutments supported that M Priers' feet is remarkable not presents a series of arches, turned upon from the long distance across countravan, with their abutments supported that M Priers' feet is years. The same distance arous countravan, with their abutments supported upon from the long distance across countravan, with their abutment supported that M Priers' feet is remarkable not only for the long distance across countravan, with their abutment supported upon from the same distance across countravant with which La Bilanc won the same distance and postance of the same distance are postance

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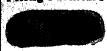
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should not make its appearance.

Langth of the Stride, It has been estimated that the variage length of a man's stride is 31% inches, and data the distance an average inches and cover at this rate is 7,163 yeards on cover at this rate is 7,163 yeards a minute. The number of strides would be 7,500 an bour, or 126 a minute. The length of the stride in the various armines is as follows: United States, 30 inches, German, 31% inches; Austrian, 29%; Italian, 29%; French, 29%; British, 30 inches

39%; British. 30 inches.

Wonderful Effects of Forests.—A striking example of the transforming effect of forests, not only on the appearance, but on the productivity of a country, is afforded by the department of the Landes in France. At the close of the Landes in France. At the close of the in that region were little more than a thirting sand-dunes and disease-breeding marshes At the present time the same shifting sand-dunes and disease-breeding marshes. At the present time the same lands are among the richest, most productive and healthful in all Prance, and the change has been brought about by intelligent cultivation of pine forests. Even the character of the climate of the region has been smellorated, and it has become mild and balmy. A thin layer of the soil, formerly impreprie surface of the soil, formerly impreprie surface of the soil, formerly impreprie surface of the soil, formerly impreprie that the soil of t

at thorough drainage is established to the spongy earth that lies below.

Postglacial Climata.—In a sumptuous quarto volume of 500 pages the Executive Committee of the Eleventh International Geological Congress has published a series of 47 memoirs discussing the evidence of postglacials changes of climate to the volume include the leading authorities. In each country concerned, on this complex question, the work may be regarded as summing up all that is known—and a great deal that is conjectured—regarding the later stages in the history of geological climate. It must be admitted that the information consistence of the confection of th United States section are Wm. C. Wm. H. Dall, F. H. Knowlton and

to the United bysics section are win. —
Adden, Win. H. Dail, F. H. Knowlton and
O. P. Hay

Five New Variable Stars.—A circular
has been received from Harvard College
Observatory in which it is stated that
atom of photograpus forming the map
of the sky, and this has resulted in the
discovery of Nova Sagittarii. No. 4, two
new variable stars in May No. 43, and
three new variable stars in other regions. Nova Sagittarii. No. 4, was visiblo at its greatest observed brightness on
May 22nd. 1901, but was not seen on a
photograph taken April 1004, 1001,
situde 14, slightly seenth of the position
of the Nova. The fluctuations in brightness appear to be somewhat similar to
t dose of Nova Persel, No. 2, during its
so-called oscillatory period, from March
to June. 1901. Prof. Pickering calls attantion in the circular to the fact that
seven new stars are known to have appeared in the flavared May of the Sky.
starting the server of 1604, which rivaled Vapus in brillianov. Nova
Ophriechi, No. 2, 165,317, appeared in
1848, and Nova Sagittarii, No. 1, 185,185, 11, 1898, both of these being on the
extreme edge of Map No. 43. Nova Sagittarii, No. 1, 185,Nova Sagittarii, No. 1, 185, 187, in
1850.



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Contents for May, 1911

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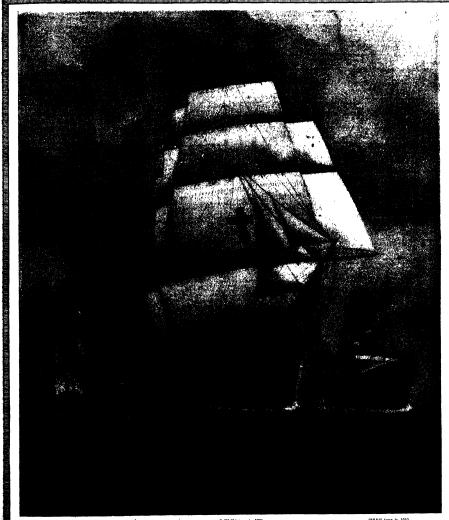


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VOLUME CIV.

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NEW YORK, SATURDAY, APRIL 29, 1911

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The Editor is always gind to receive for examination illustrated articles on subjects of timely interest. If the photographs are short, the articles done, and the fasts authentic, the contributions will receive special attention. Accepted articles will be paid for at require space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

One of the Dangers of Flight in a Wind

REQUENTLY, in describing the sensations of flight, particularly at lofty altitudes, airmen have stated that when they have risen in wmdy weather to a great altitude it is difficult, and at times impossible, to tell which way the wind is blowing. They say that it is difficult to determine by the sensations, whether the air is still or in motion, and that as far as the progress of the machine through the air is concerned, they can speed up or slow down, reverse its course and perform other maneuvers with the same case and with the same manipulation of the machine as would occur were the flight being conducted in absolutely still

air and near the ground.

There is one important exception to this statement, through ignorance of which it is quite possible that some of the airmen who have fallen from great that some of the armen who have rance rrom groun-heights have lost their lives. We refer to the fact that if a machine which is flying against a strong wind be suddenly turned so as to travel with the wind, it is hable to lose its equilibrium beyond any

wind, it is lable to lose its equilibrium beyond any chance of recovery.

To take a concrete case, let us suppose that an arcoplane, capable of flying at a speed of forty nules an hour through the air, is being driven against a stady 40-mile gale, and is therefore hold-ing itself statuonary with regard to the earth. The writer witnessed exactly these conditions during the nucel hast October at Belmont Park, when Hoxsey started against the wind, progressed slowly in his skyward clumb, his speed with reference to the earth the codily decreasing as he was into the higher and steadily decreasing as he rose into the higher and more rapidly-moving strata of air, until he reached a 10-mile wind, when, for several minutes, he was poised stationary over the aviation field. In passing, poised stationary over the aviation field. In passing, we may mention that Wilbur Wright, who was carefully watching his pupil, drew our attention to the fact that here was a heavier-than-air machine maintaining itself perfectly stationary in mid-air a thousand feet above the ground—something which, a few years ago, would have been laughed at as an utter impossibility.

Now if the average man on the street were asked

what would have happened if Hoxsey had made one of those swift turns, in which the machine is reof mode switt turns, in which the machine is a versed in a few seconds, he would probably say that it would have set off in the reverse direction at a speed over the ground of some eighty miles an hour, 40 miles of its speed being due to the wind or the whole moving body of the atmosphere, and the other 40 miles being due to its own speed through that atmosphere.

Also, we very much fear that many of the new-comers among the flyers would make the same

assertion.

As a matter of fact, nothing of the kind would happen; for if a swift reversal of the position of the machine were made, so that In a few accounds it were facing in a directly opposite direction, the factia of the machine would tend to hold it standard with regard to the earth; and the inertia would have to be gradually overcoune, and the machine accelerated, until it reached a speed of 50 miles due to the wind, plus as many miles per hour more as would be necessary to enable its planes to obtain the necessary reaction for support and proper qualibrium. port and proper equilibrium:

Indeed, could Hoxsey have immediately reversed his machine, he would have found himself in the position of moving through the air tail first, which would mean that the air pressure would be acting on the upper instead of the lower surfaces of his

planes, tending to drive the machine to the ground. Hence we see how extremely dangerous it would be for an airman who was flying against a strong wind to make a sudden, sharp turn of 180 degrees. The experienced aviator is well aware of this danger; ose of us who witnessed the wonderful flying of Latham in his Antoinette machine, when he circled the field in the same gale of wind to which we referred above, will remember that in moving out of the wind to run down the course with the wind, he turned his machine so slowly as to cover from a third to half a mile before he was straightened out with the wind at his back.

ened out with the wind at his back.

Is it not possible that some of the unexplained
disasters of the past twelve months have been due
either to ignorance or disregard of the conditions
above mentioned?

above mentioned?

This subject was discussed by James F. Stephens in an article read at the last meeting of the Western Society of Engineers, on "The Dynamics of the Flying Machine." As the result of his investigation of the dynamics of flight in a wind, the author believes that the fact is demonstrated that in making a turn, the necessity for quick changes in the actual velocity of the machine, required to accommodate its speed to the speed of the wind after the direction of the machine is changed, may be such as to cause the machine to fall for want of sufficient surplus power to meet such variable conditions.

The full text of the paper, which is too lengthy republication in the Scientific American, will be found in the next issue of the Supplement.

Secrecy in Modern Industries

N connection with the recent semi-centennial of A connection with the recent semi-centennial of the Massachusetts Institute of Technology, Prof. William H. Walker, in making a plea for a more generous publication of recults obtained in modern industrial research laboratories, declared that the old slowers—nevel to recent the still inand was depriving the world of much knowledge that the discoverers could share without harm to

There is a heavy moral obligation on the part of large industrial organizations having fully equipped research laboratories, said Prof. Walker, to conresearch laboratories, said Prof. Walker, to contribute their share to the advance of the world's knowledge. They have well stocked libraries, and are provided with all the current periodicals; they profit by all the scientific work which has been done and is being done. This is as it should be, and such firms are to be commended for their progressiveness. But is this not a reason why such laboratories should do their part in adding to the sum of available knowledge? There is in every laboratory nuch work which could be published and yet conserve the interests of the corporation. First, there are the results which may not have proved valuable are the results which may not have proved valuable to the laboratory in which they were obtained, but which would be of immense value to someone else working in an entirely different field. Second, there working in an entirely different field. Second, there are those results of value to the laboratory peasesing them, but which could be published in an unapplied or "pure" form and which would make an important contribution to science, and at the same time the publication would work no injury to the company or corporation most interested. And finally there are those results of operations and processes, machines and apparatus which, if the truth were known, are possessed by a number of concerns, but we held as valuable servers by each. Ferrome. known, are possessed by a number of concerns, but are held as valuable secrets by each. Everyone would profit and no one be the loser by so farsighted and generous a policy. Germany is very justly held up before us as a shining example of marvelous industrial progress and prosperity. A very great deal of the credit for her present position to her splendid educational system. is due to her splendid educational system. But no small factor in her national progress is the helpful attitude which her industrial organisations take toward the publicity of scientific data. The indi-vidual does not suffer, while Germany, both from a purely scientific and an industrial standpoint, is rapidly advanced. But too often with us the presi-dent and his board of directors are alchemists; they dent and his board of directors are alchemists; they fall to see why, if they pay the salaries of their research men, they should give to the public, or their competitors, any part of their results. They exclain "What has posterity done for me?" They would have their laboratories remain the secret chambers of the alchemists, and continue to improve their methods of changing baser materials into gold without regard to the obligations which they owe to their fellows.

Although Prof. Walker's claim that "the spirit of alchemy" is still rife in modern industry is largely true, it is but just to state that there are some metable exceptions, as witness the Physical Laboratory of the National Electric Lamp Association, reference to whose work was made in our recent issue dealing with light and heat. Although this association includes the majority of the leading lamp manufacturers, there are several important firms that manufacturers, there are several important arms taut make no contribution whatever to the expenses of the laboratory. Nevertheless, the valuable results of the costly research work of this institution are published broadcast to the world; the members of the association believing that the advancement of an industrial art by world-wide co-operation results in greater benefit to the individual firms than can possibly be obtained by separate and secret investications.

April 40, 1911

Upper-air Research in Great Britain

Typer-air Research in Great Britain

We sountries lead the world to-day in the study of the free atmosphere—aerology—via.

Germany and Great Britain. In Germany, where serial navigation is a sort of national fetich, under the exalted patronage of the Kaiser, every branch of science relating thereto is being cultivated with enthusiasm. German metocorologists—and Germany has more metocorologists, correctly so called, than any other nation—are becoming practical acromatis; while German acromatis are studying the taan any other nation—are becoming practical acro-nauts; while German acronauts are studying the science of the atmosphere. In Great Britain, where there are fewer professional meteorologists, the number of educated people, on the other hand, who there are fewer professional meteorologists, the number of educated people, on the other hand, whitake a dilettante interest in meteorology is probably even greater than in Germany. The term dilettenic is not here used in a dusparaging sense. The Royal Meteorological Society numbers among its members secores of persons who have made substantial additions to our knowledge of the atmosphere in the leisure intervals of making laws, practising medicine, administering justice, cultivating the soil, and what-not. This circumstance is characteristic of British science generally, but perhaps especially so of British neteorology.

The Quarterly Journal of the Royal Meteorological Society for January of this year is almost entirely devoted to serology. The opening article, by Miss Margaret White, a voluntary observer at the Howard Estate Observatory, Glossop Moor, attached to Manchester University, describes the results of a remarkable series of sounding balloon observations made March 18-19th, 1910. The principal object of these hourly observations was to study the diurnal variation of the height and temperature of the isothermal layer, and this was found to be waveteally wid. The height and temperature of the

of the isothermal layer, and this was found to be of the isothermal layer, and this was found to be practically sil. The height and temperature of this layer are in close relation to the barometric pressure conditions at the surface, but appear to be quite independent of the time of day. On an average the layer began at an altitude of cleven kilometers above the earth's surface.

W. H. Dines, the veteran English aerologist, describes the computing of Auditorians.

W. H. Dines, the veteran English acronomics, was cribes the campaign of ballon-sonde observations carried out at several points in the British Isles during the "international weeks," December 6-11th, 1909, and August 8-18th, 1910. In the second series 1909, and August 8-18th, 1910. In the accord series the average height attained by the balloons was 16.5 kilometers, a little over 10 miles. C. J. P. Cave describes the results of pilot-balloon observations made in Barbados—1. e., within the tradividence of the construction of the cons H. Ley gives an account of his balloon experi-ments at Blackpool, England, and in this conments at Blackpool, England, and in this con-nection five amony useful suggestions regarding the ferhisque of such observations, and some rather novel conclusions as to a subject that is becoming con-spicuous in the study of aeronautics, viz., wind structure. Surface winds are well known to be oscillatory in character, i. e., subject to rapid varia-tions of various catestics. tions of pressure, velocity and direction, altogether analogous to sound waves, but much larger in period, analogous to cound waves, but much larger in period, wave-length and amplitude. Like sound waves, these confiliations in the wind appear to give rise to the phenomena of reflection, refraction, difference, etc. Capt. Ley endeavors to show the relation between these cacillations and those of atmospheric pressure at the cattle surface, as recorded by the microbarograph. The subject of show price pressure variations is further discussed by Wilhelm Schmidt, of Vicana, who gives the first account the English of his new instrument, the variograph, and the Tesults obtained therewith.

The will and later



Wilhelm Ostwald

A Leader in Modern Philosophy of Science

Aging the figures which loom large in the splender odingsiny of living German men of science, there is problem; done whose life work and personality present a greater interest to the general public than Withbim Ostwald, whom we may justly call one of the founders of modern physical chemistry.

In drawing an estime sketch of the life of the great clientest and philosopher, we may pass over in a few words his early youth. He was born in 1853 at Rigs, on the Baltic coast of Russia. It can not be said that in his boyhood he manifested any very striking indications of his genius; in fact seven years, instead of the usual five, were spent in absolving his regular school courses. He showed, however, a distinct taste for experimental work, especially along the lines of chemistry. In 1872 he was sent to the university at Dorpat. Here also he did not at first give any obvious signs of his coming greatness, though he sequived even at this early stage a requitation among his fellows for the great width of his interessis and faculties, a feature which in later life

has proved one of his most striking and remarkable characteristics. Presently, how ever, the young student set to work with a will, and astonished all by passing his examinations in an incredibly short time steadily and certainty. In 1875 he was ap-pointed assistant at the university, and later advanced to a lectureship While still on the very modest salary atwante setti on the very mouses using ac-tached to such a position, Ostwald in 1880 took upon himself the responsibilities and burdens of wedded life. He half himself drawn a quaint picture of these days of small circumstances and great aspirations in his recent book, "Die Forderung des It became necessary for him to add to his siender resources by spending two or three hours each day teaching at a boys' school, while carrying on as usual his university duties and laying the foundations for his great Lehrbuch, which to this day is by far the most exhaustive treatise on physical chemistry extant. But promotion soon came In 1881 Ostwald received a call to a professorship at Riga. An idea of his success as a teacher and investigator during his tenure of this office can be obtained from the figures showing the enrollment of students in his laboratory, and from the fact that during the period 1881-1887 he published no less than thirty original investigations. The number of students in his laboratory increased from 81 in 1881 to In the meanwhile the department of chemistry had been enlarged, under the personal direction of Ostwald himself. who had been delegated to visit the various laboratories and institutions of Eu with this object in view. This was his first journey from his native land

Among the students trained by Ostwald at

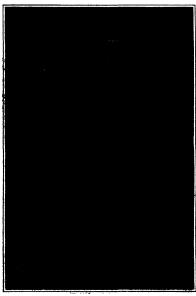
Among the students trained by Ostwald at Riga were a large number who achieved considerable success in after life, but above all others among this number stands out Arrhenius, the originator of the ionic theory.

Nernat also, one of the greatest physical chemists of the day, was planning to study under Catwald at Riga, when the latter was called to Leipzig in 1887, whither Nernat followed him to become his assistant.

Normat followed him to become his assistant. This year was a peculiarly eventful one for the young science of physical chemistry. It saw the birth of Arrheniur's theory of electrolytic dissociation and the enunciation, by wan't Hoff of the laws of comotic pressure, with the important results in the theory of solution which flow therefrom. In the same year obtwald founded the Egitachity fir physicalische Chapute, which has remained ever states the chief organ for the publishing of original work in physical chemistry.

Ostwad's creative work is imposing even if we consider only its volume. During the altituser years consider only its volume. During the altituser years 1347 to 3500 he published's total of to less than 16, 400 pages of ordinal pages, act books, reviews and other matter. Since 1991 he has edited the Assacles of the "Jesephilages, and to place a large season for the purpose of providing an organ for the Assacles of the purpose of providing an organ for the Assacles, and the part receptor of self-special control of the purpose of providing and the part receptor of self-special control series of classical golds: a providing and the part proposed of the purpose of providing and the page of the purpose of purpos

to the theory of electrolytic dissociation and the theory of catalysis. The field of application of the former is of course almost boundless, and Ostwald has taken an active part in the development of many of its ramifications. One application, which is of pe cultarly fundamental importance to every chemist, is the elucidation of the reactions underlying common methods of inorganic analysis. This last topic Ost wald has treated in collective form in that admirable little book, "The Scientific Foundations of Analytical Chemistry." His work on catalysis Ostwald brought, as it were, to a culmination about the year 1901. While this subject remains to the present day shrouded in much mystery, the view has been greatly cleared by his labors. He first of all established a clear definition of what constitutes a catalyzer, and then drew attention to the laws of catalysis which can be deduced from the second law of thermodyna--namely, that a catalyzer can not affect the equilibrium ultimately attained in a system in chemical reaction, and, as a corollary to this, that a catalyzer



PROF. WILHELM OSTWALD

must affect in the same proportion the velocity of both members of a pair of opposing reactions

Of late years, especially since his retiring from university teaching. Ostwald has devoted his main efforts to writings of a philosophical and general claracter. We might date Ostwald's public careers as a philosopher from the year 1901, when he delivered at Lednig Ruberstip a course of lectures on "Natur-philosophis," a term which perhaps may here be interpreted as meaning a system of philosophy founded upon and dealing with the fundamental facts of natural science. These lectures have since bentlements of the published both in German and in English. The dominant note that sounds again and again in this work, and indeed in most of Gewardie writings, is his insistence on the significance of energy and the laws of energy transformations in our interpretation of the physical universe. In so far as living organisms and main finness from part of this universe, and are subject to physical laws, the study of energetics forms a condition of the phenomena presented to us by herr matter, but the properties and behavior of living organisms and communities. Thus one of the more recent of Ostwald's books ("Eksepsticohe Grundlagen der Kultur-wissenschaft,") 1300). Is devoted to the exposition of

the application of energy considerations to problems of succlosey and related portions of science. The supreme position which the energy concept occupies in Ostwald's mind has found expression in the name chosen by him for his country home in Saxony. "Landhaus Energie."

Another cause for which Ostwald has raised his voice in constant and urgent advocacy is the cultivation of a point of view free from hypothetical assumptions. He points out how in the past hypotheses have often been an obstacle rather than an aid to progress, by introducing into our concepts elements forcign to the actual phenomena under consideration. Thus, until quite recently, odtwald refused to make use of the mechanical theory of heat, according to which this phenomenon is to be construed as "a mode of the mechanical theory of heat, according to which this phenomenon is to be construed as "a mode of the mechanical theory of heat, according to which this phenomenon is to be construed as "a mode of the mechanical theory of heat, according to which this phenomenon is to be construed as "a mode of the mechanical theory of heat, according to which this phenomenon is to be construed as "a mode of the mechanical theory of the mechanical theory of the mechanical through the construction of the mechanical through the construction of the mechanical through the construction of the mechanical through the mechani

Ostwald's view, was not only unnecessary, but undsirable This view was maintuined in the
face of the brilliant work of Hernoulli,
Watersion, Clausius, Maxwell. Boltzmann
and others, which, by a triumphal feat of
human ingenuity, furnished actual numerical estimates of molecular dimensions. To
properly resilize what this means, we must
recall that for example the diameter of a
molecule (supposed spherical) is thus found
to be of the order of 0 00000002 continueter,
or 0.00000001 inch, while the smallest object
of which a microscope can under ordinary
circumstances form a distinct image is of
the order of 0.0001 inch, and this limit is
due, not to imperfections of the microscope,
but to the inherent properties of light, so
that it can never be passed by the ordinary
method of using the microscope.

This impresses us at once both with the brilliancy of the intellectual achievement of the workers in the kinetic theory, which enabled them by various methods to obtain very fairly concordant estimates of the di mensions of such excessively minute objects, and also with the seeming justification of Ostwald's objection, that such hypothetical estimates were worthless, since there was no means of confirming their truth by experi But the unexpected has happened Recent developments in ultra-micr have furnished the most brilliant vindication of the point of view of the kinetic theory The powers of the ultra-microscope stop short, it is true, of the average mole cular dimensions of the simpler bodies. But Zeigmondy has succeeded in obtaining direct evidence, by means of his ultramicroscope, of particles of gold whose di-ameter is only about four times that calculated for a molecule by the kinetic theory Moreover, the study of very small particles in suspension, and of the Brownian move ent which they display, and other rec developments, especially in the field of electricity, have given the most striking con-firmations of the conclusions reached by the

methods of the kinetic theory.

In the face of this turn of events Ostwald himself has now withdrawn his opposition to the kinetic theory, and has publicly gone over to the side of its deherents. The question might now he asked: Of what value, then, are the somewhat complicated arguments which were brought forward by Wald and strongly indorsed by Ostwald (among other occasions in his Paraday lecture, 1804), to show that the laws of chemical combination were explicable independently of the atomic theory? The answer to this, in brief, is that the clearing up of the fundamental concepts and methods of accientific floubit is quite as important a matter as the addition of isolated facts to our store of knowledge.

The extraordinary breadth of Gaswali's interests and productions makes it hand to judge at the present time the full waits of his work, for his influence must in time become felt in the must have fine become felt in the must have fine become felt in the must have fine felts of knowledge. Little hesitation need, however, he felt in prophessing that future workers in science and philosophy will trace back many assumes of thought, many paths of progress, to the influence of (dawalids writing and teaching, and many as growth that will matter in after days will be found to have had its germ in some point or principle forestadowed in his series.

The Voisin "Canard" Biplane

How Gabriel Voisin Invented His Biplane Christened the "Duck"

THE photographs reproduced on this page show a new type of biplane brought out of late by the Voisin brothers. This machine has a long body projecting in front, and, when in flight, it has the s earance that a Blériot monoplane would have if flying backward. The horizontal rudder is placed at the extreme front end of the long tapering body, and it occupies the same position that the tall occupies in a monoplane The motor is at the rear end of the body (corresponding to the front end of a monoplane), and the two planes are attached to the body and mounted over a pair of wheels at this end The ends of the planes are connected by vertical partitions, such as were used in the Voisin machine in its early stage of development. There is a second pair of wheels placed below the body at the front, and the where places below the body at the front, and the vertical rudder is mounted above the body at this end also Beside the body, just above the wheels, there is on each side an inclined fin that looks for all the world like the mud-

guard on an automobile.

The spread of this new biplane is about 36 feet, and the planes are 6 feet 7 inches in width. The planes are spaced 5 feet Their total supporting surface is apart Their total supporting surface is 474 square feet. The planes are set at a slight dihedral angle. The dimensions of the horizontal rudder at the front end of the body are 12 feet by 3 feet 7 inches. It contains about 32 square feet of supporting surface, while the vertical rudder has 61/2 square feet. Below the planes at each end there are curved skids in case the machine tips when near the ground. The motor used is a 50 horse-power Rossel-Peugeot re-volving-cylinder motor, which resembles the

Gnome.

The first flights of the "Canard," or "Duck," as it is when translated, were made early in February at Issy-les-Moulineaux by Collieux On February 3rd he carried two passengers in a strong wind of 25 miles an hour, and the machine flew 25 miles an nour, and the machine new very steadily and gave an excellent per-formance. On February 5th he demon-strated its turning abilities before a number of military men, and again, the followber of mintary men, and again, the follow-ing day, he flew with passengers. The pilot's position is 6 or 8 feet in advance of the main planes, and when a passenger is carried he is seated back of and above the pilot.

Regarding the conception of this machine and its advantages, M. Voisin says, in La re Automobile et Aérienne, it was conceived as the result of his various experiments. In 1904 he was experimenting and building a machine for M. Archdeacon. The main surfaces consisted of two superposed planes, 10 meters by 2 meters in size, and having placed at 31/2 meters in front, a horizontal rudder. The "Canard" was practically the same machine with the body lengthened 5 meters in order to bring the horizontal rudder that much farther forward of the planes

e above experimental glider, which was tested at Berck-sur-Mer when Voisin was experimenting with Captain Ferber, was in-

strumental in giving the former the European record of duration in a glider, which was 64-5 seconds. following year he added a rear cell or biplane tail and experimented in towing the same above the Seine, the results being so satisfactory that Delagrange and Farman fitted motors to similar machines and were soon making successful flights.

This original Voisin machine, which was changed This original Voisin machine, which was changed in every conceivable manner by different experimenters, and which schleved its great success in the hands of Hanri Farman, M Gabriel Voisin believes reached its highest point of development last year. In his opinion, however, it is a dangerous machine in landing, and is difficult to maneuver on the ground, being cumbersome and not at all strong if it is badly constructed. Finally, he does not believe it capable

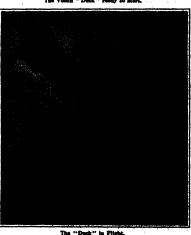
of further improvement.

Santos-Dumont, in 1906, had his first success with santos-Dumon, in 1906, had his first success with a machine similar to the "Chanard" in many respects. Heriot imitated Santos-Dumont, and also tried a monoplane with the elevator in front. The had location of the centers of gravity and pressure and a sharp dihedral angle obliged Santos-Dumont to give up the type of aeroplane which he used successfully at first, and to devolop the "Demoiselle" with which .

he flew later. Last year M. Fabre, at Marseilles, made successful flights with a monoplane similar to the "Canard," this machine being the first aeroplane to rise successfully from the surface of the water and make a flight. Only last February did Glenn Curtisu accomplish this same feat with a biplane. As fate as last July M. Voisin was shown by M. Lacoin a model of an aeroplane similar to the "Canard," and model of an aeropane similar to the "cantu," and having the rudder in front and two propellers back of the main planes. This little machine surprised Voisin greatly by its truly extraordinary stability. Although he did not have the dimensions of the model, he finally constructed a machine along these es, and the tests have shown it to work remarkably well. He believes that the great need of aviation is an aeroplane that is sure and comfortable, and that has its seat hear the ground, while it is easy to maneuver on ferror firms and is so designed as to



The Voisin "Duck" ready to start,



THE VOISIN "CANARD" BIPLANE

do away with accidents due to the propeller. It was only after a great deal of study and figuring that he fulfilled these conditions, as he believes, in the "Caused." He does not know what form the acceptage of the future will have, but he believes that, the the

of the future will have, but he selieves una, nac une "Canard," it will resemble very closely an arrow. He expects that this new form will be widely copied as soon as its good qualities have been more thoroughly demonstrated, but he hopes that the converse that th oughly demonstrated, out as nopes that the con-structors will take care to make strong and reliable machines, so that his invention will not be given a bad start, and that its excellent qualities will be brought out.

The Automobile Pire Engine

In the passing of the attend fire ungine in fairby of the high pressure system of independent water mains and hydraux, now despite eachige each only the best practice but as shoulte ascentif for all large cities, there are many mechanical equitions to be considered that lend increased imperiasis to be considered that lend increased imperiasis to these familiar portable pumping machine desinguing through our city streets. Newtonizations the through our city streets. Notwithstanding the triumph of high pressure systems and control at

tion pumps, the day is far distint when their will comployed archaeredry, and for many many fine and pority of American ottles will be estimated to refer fire angines for protoston. The granted estimated or angines for protections. The granters, so, extend inaugurated, means not only a long stap to toward efficiency, as sequend in increased approximately and the ability to transport heavier and powerful machines, but also the development of types of apparatus that are radically different. The are economical and effective substitutes for horse-drawn fire engine, and at this time it is interest to consider the various types.

The first proposition is to eliminate the runni and draft gear of the front wheels of the five en-

give and substitute a foul-wheel motor changes, thus making a through piece of gaparatus, as is done in the trackor for water towers and commercial heavy whiches. Guch a channis may have either powerful gas engines or a combined gas-sectric driving mechanism with motors at each of the four wheels. This means simply adding the tractor to any arising fire engine without the slightest alteration, and alloyed complete interchangeability. This device has worked successfully with year; towers, actuation ladder trucks and corrections. artoris complete interchangeability. This device has worked successfully with water towers, extension laster tracks and on-mercial vehicles, and manufacturers are de-airous of applying it to the heaviest steam Then there is the plan successfully real-

ised in the new engine for the New York Pire Department, recently described in the SCIENTIFIC AMERICAN, and in one b SCHEMING AMERICAN, and in one being re-built for the Birutingham, Ala. Fire De-partment, where the frame is longthaned and a powerful motor placed in front of the engine proper, but geared by chains to the rear wheels. This arrangement gives a complete and compact four-wheel place of appearatus capable; set high speed with hill, described the set of the set of the set of the four-place of the set of the set of the set of simpling hypers process. Both of these tyres with completes process. Both of these tyres ja which it has been applied it has worked with complete success. Both of these types of machines require no change in the pump-ing machinery and boilers, which present all the advantages and disadvantages of the steam engine when compared with the internal combustion motor. With both com-bined in one machine this is quite apparent. There is the increased weight of boiler and engine with fuel and water, the appreciable amount of time required to get up steam, and the necessity of maintaining a boiler at the fire house. Furthermore, there is the rapid deterieration of such a machine in service and the difficulty of securing en-gineers adequately trained and capable of gineers adequately trained and capable of maintaining the fire engine and operating it at highest efficiency. In other words, should not the steam engine follow the horses, and gas engines be used with the pumps as well as for propulsion?

as nor propulsion? The answer to this is found in a third type of fire engine, where the engine can be disconnected from the driving gear and linked up with the gamps. This is now done for small and implementated machines that even now have a wife sphere of usefulness, in the number of

especially in the subspite and for rural districts, and for first sixtus calls in small cities or residence dis-tricts.

recating pumps are use Both rotary and rects with such machines, and they are receiving thorough tests in actual practice and improvements at the hands of manufacturers. As yet no maker of graciline enor manuresprave. As yet no maker of gasoline on-gines has announced his shiftly to put out the equiva-lekt of an extra first size sagine that can travel to a first at a speed of thirty miles an hour. If this can be done and the record of the steam five neglec for regisability and power be equaled, then the motor five eagine will in a law years supplant all other types. Otherwise steam apparatus will long be found in

Reducing Zinc Ore With Potes

The certain economic conditions cost to tee a for use in reducing size seen. Hugher and liave found that these cost size to reducing factority with crude polysheps, after proland

A Painting in Glass on a Canvas of Concrete

Mosaic Curtain of the Mexican National Theater

Will is an acceptance to leak upon Europe as the person of all art that he does not even stop to ask relative range good to the form of the first state of the little to prove a distinct surprise to stamp that the architect of the beautiful participal Theorem of Maxico, after hunting the world over for a seitable material to build the curtain of the theseion, and an artist to depict upon it an appropriate sound, suited his quest successfully in New York

The subject chosen was a view of the twin mountains Popocategeti and Intaccibualt that rise far above the snow line 45 miles southeast of the city of Mexico. There is a tegend connected with

that has been m the time of s, which runs as follows: In the days of Montesumes there was a powerful mon-arch who had a besutiful daughter names and cibuatl. Her lover Popo was required by the to prove winning a certain number of batties before he could attain the hand of the prinmentime he was not even to see his love. But unable to wait, the lovers met in secret, and when this was discovered the king, in his wrath, turned them both into mountains. The cold outstretched form of the princess may be clearly made out on the snow-topped mountain Intaccinuati, and it is said of Popo that although he was turned into a mountain, the fires of his love could not denoed by the amoke that pours from the lofty peak of Popocatepell. It was this scene that the architect Adame Bearl duce because * 4t is typically Mexican and is one of from with Ħ.

the paint and cause it to blister and peel. It was next Vesetian and Bohemian glass was investigated, but the desired result could not be obtained. Finally it was suggested that the curtain be made in mosaic of Tiffany "Lustre" glass, and this proved to be just the material required. The glass is possessed of a billiant opalescence due to a process discovered by Mr. Louis G. Tiffany. In the composition of the glass metals such as fron, it, antimony and the like are used. The metals are then brought to the surface by reducing the glass in a fizne, and the opalescent effect is further heightened by sublettine the glass to metal-

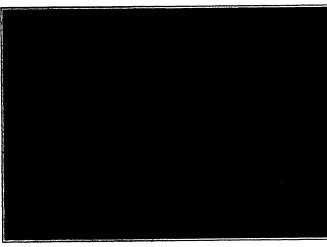
lic fumes The variations of colors produced by casting different shades of light upon the glass are exceedingly beautiful, and well suited to reproduce the play of light upon the famous mountains under the glow of the setting sun.

In order to make a true picture of the scene an artist was sent to Mexico to paint the requisite details. The task of reproducing the paintings in glass was no small one. Twenty measic workers have been employed for over fifteen months at this work under the direct supervision of Mr. Tiffany Bits of glass a fraction of an inch in area are inlaid in a backing of freproof cement an inch and one-half

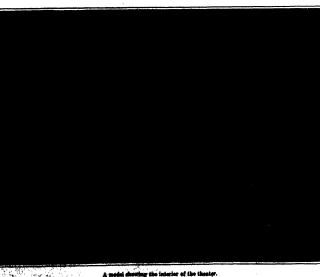
inch and one-half thick, and this in

turn is sup-ported upon a steel frame a million separate pieces of glass, covering an area of 2,500 square feet The en-tire weight of curtain the twenty-seven tons and yet in place it will be raised or lowered in but seven seconds by hy-draulic mechan-It would be impossible to make the curtain in a single sheet of the dimen-sions required and transport it of Mexico. For this reason it was decided to divide it up into sections. as shown in the accompanying graving Each of the small sec-tions is three feet square. They are placed in a bronze frame which conceals the joints and gives one the impression that he is viewing the scene through the panes of large window. While the

the scene are reproduced in "Lusglass, and glass is used to a large extent throughout the scene, the snow on the creats of the mountains is reproduced in dense opaque glass, so that it always appears snow white only a slim't tinge as different colored lights are cast upon it Onof the drawbacks that an artist who paints on canvas has to contend with is the fact that his pigments do not reflect sufficient light to portray accurately a



A twenty-seven-ton theater curtain of gines messic, showing the lover mountains Popocatepetl and Ixtaccinuatl.



MORAIC COURTAIN OF THE MEXICAN NATIONAL THEATER

Continued or

American Merchant Marine

An Expert Analysis of an Important Economic Problem

By Francis T. Bowles

THE writer of the following article needs no introduction to the readers of the Scientific America. He will be recognized as formerly, for several years, the Chief Constructor of the United States Navy Recently, in the face of close competition from the leading yards of Great British and the Continent, he was successful in securing to America a \$22,000,000 cm tract for two Armenties at Italications, His article is a lucid and highly authoritative contribution to a discussion of supreme national importance.—Borotrance

It has been officially estimated that citisens of the United States pay for the transportation of their over-sea commerce, including freight, passenger fares and mails, the sum of \$229,100,000 annually. This estimate is on a low basis of freight, and it is believed that the actual amount paid is nearer \$300,000,000. Practically the whole of this business is in the bands of foreigners, and this expenditure is paid to them and must be considered as an item against the United States in the balance of trade, on account of which we must export products of the United States in payment.

Sound Economic Reasons for Protection.

There is, therefore, entirely apart from the military value of sea power, a substantial economic reason why the United States should become a carrying nation. The experience of sixty years of free trade in ocean transportation has conclusively shown that it is not profitable to American capital under present conditions and requires protection or some form of government aid or subsidy. A comprehensive system of such protection, which will admit of development of either cargo or mail steamers as the necessities of trade require, should include

First. Mail compensation to steamers such as is provided and now authorized under the ocean mail act of 1891

Second. Remission of the head tax of \$4 on immigrants arriving in American vessels, which would be a substantial advantage to American mail steamers.

Third A discriminating duty applicable to vessels of all types, but especially adapted to the development of earge vessels under individual ownership. A method of applying a discriminating duty which would not disturb the free list, and would not appreciably affect the market of value of imported merchandise or materials would be to neate a law providing that on all goods imported in American vessels on which he advalorm duty exceeds 41 per cent, there would be a reduction of 5 per cent, and on all goods on which the advalorm is 41 per cent or less, or which are non-dutiable, the importer should receive an importer's certificate available only for the payment of duties at the Custom House and equal in value to 208 or cent of the value of the vacous as imported.

ourse at the custom rouse and equal in Value to 200 per cent of the value of the goods so imported aff. The average rate of duty under the present tariff is understood to be 41 per ent of evidence and 206 is 5 per cent of 41. These figures may not be exact, but they are intended to be sufficient to create a demand for American cargo boats in the foreign trade, by enabling the ablipper to pay such vessels a higher rate of freight on homeward voyages, and enough higher to overcome the handleap of higher cost of vessels and operation under the American fig. They are probably sufficient for the purpose on all except some low-priced bulky cargoes.

On outward voyages the American would be obliged to take the competitive rate.

If, then, all our imports were carried in American vessels and half the goods were free or non-dutiable, this proposed law would be equivalent to a 10 per cent reduction in the tariff

cent reduction in the tariff.

The total value of imports in the United States for
the year ending July, 1910, was \$1,552,000,000 1 it,
under the operation of the laws proposed above, citizens of the United States should acquire the carrying
of, say, 3500,000 worth, or about one-third of this
amount, in American vessels, it would probably he
necessary to sequire under the American flag about
500 additional vessels, of various types, which might
have the average tonnage of the foreign steam vessels entering our Atlantic ports, or about 3,000 gross
tons. It would probably take ten years to built these
vessels at a cest of about \$500,000,000 if built in the
United States. They would employ of board about
40,000 men, and would be earning from \$50,000,000
to \$100,000,000 gross annually. The total cout for the
annual charge on the United States at that time under
to laws proposed would be approprimately \$1,000,000.000

a year, and during the ten years in which this business was being acquired might have amounted to \$50,000,000.

This, in a broad way, is the problem which we are considering in the acquisition of a merchant marine in the foreign trade.

The Free-ship Fallacy.

It has been proposed to build up the marchant marine in the foreign trade in the hands of American marine in the foreign trade in the hands of American citizens by permitting them to buy shipe built by the citizens by permitting them to buy shipe built by foreigners and place them under the American fise, and that is a question which should be faced and distance of the control o

We know from sixty years experience the result of free trade in ocean transportation, and that since it was established our shipping in the foreign trade has continued to diminish until it is now insignificant in amount, carrying only if per cent of our imports and exports. This should lead us to consider with some considerable reluctange the extension of a policy which has sixted moderned under such sensities.

which has already produced such results. Merchant vessels can be built in Engiand and Germany for prices 40 to 50 per cent less than United States prices, because the cest of labor, materials and manufactured articles going to make up the cest of a United States vessel is bigher. The cest of the average merchant vessel to the shipbuilder is nearly equally divided between labor and materials; the materials including a large proportion of manufactured sarticles, pumps, machinery, electrical and plumbing supplies, all of which are protected by the tartif. The shipbuilder's labor costs are 70 to 100 per cent greater than the foreigners. The material costs are 15 to 20 per cent greater of duty of shipbuilding materials for vessels in the foreign trade and limits such vessels to not more than two months' service annually in the coastwiste trade. This privilege has been used by the shipbuilders and American owners in very fow instances.

Why We can Build Battleships Cheaper Than

Under present conditions of the amount of ably-building available it cannot be anticipated that this relation of foreign to local cost will be materially changed in the next tent years. These facts are not affected by the ability of the United States to compete with foreigners in the building of battleships, that being so in spite of the fact that the American shipbuilder's costs on the build of the vessel are greater than his foreign compettor; but this handlesay is overcome by the ability of the American armor and gun manufacturers, who supply half of the cost of the vessel, but undersell their foreign competitors. It is well known that the cost of operation of steam vessels is lower under foreign flags than under the American, and testimony given before the Merchant Marine Commission was to the effect that foreign contact principally due to less cost of wages. There here been some notable examples of transfer of vessels in: the foreign trade from American to foreign flags to take advantage of these conditions.

Foreign-built Ships Would Cost More to Operate.

It is certain that foreign-built reasoir cannot be as proglably operated under the American as under foreign fings in the general foreign trade. There are probably seems special trades operating to Central America, the West Indias or British North America, in which the conditions of operation would be seemstly local affor in which the lower first cost of a foreign vessel would be an advantage. If foreign westel would be simply a special privilege; it would not create new business nor reduce the cost of transports.

tion; it would not create an American merchant

It is probable that free trade enthusiasts will not be patient enough to verify these statements, and will favor the treatment of the uncerhant marine to a pre-scription of blood-letting by means of a free-skip bill, to see how it works. A free-skip bill would give special privilege to a few short reutes. It would gave an apparent increase in tomage in the foreign trade, and would ultimately result in the admissions of foreign built vessels to the const trade and thereby in the inevitable destruction of American shipbuildings and consequently of any real American shipbuildings and consequently of any real American shipbuildings raise industry, which is now mensood by free trade, has produced the shipping of the United States, which on June 50th, 1919, including all kinds of documented shipping, completed 25,749 vessels of 7,190,9035 tons.

Merchant Marine as Naval Auxiliary.

If we suppose for a moment that the military advantages of sea power made it necessary for the United States to have in the foreign trade a merchant marine of vessels adsonate for carrying onel. ons, troops and to serve as fleet auxiliari that the question was simply how to produce that merchant marine as economically and as quickly as possible without regard to its effect upon American citisens engaged in shipbuilding and its allied occupations, undoubtedly the quickest and cheapest way would be to admit foreign-built vessels to American reg and to give them sufficient of the advantages of mail ation and discriminating taxes to overc the disadvantage of operation under the American fing. By this means, in acquiring the 500 vessels necessary to carry one-third of our imports under the sary to carry one-tind of our imports under the American fig., we should sure possibly \$75,000,000 of the \$200,000,000 of the \$200,000,000 necessary to produce those ships in American shipyards and we could reduce by nearly one-half the aid which we would be obliged to give to American-bully vessels. By this means we would have answered the military necessity for a feet of auxiliation of the could be also as the could be also aries at the least possible expense. But we would not have placed the merchant marine on a sound and continuing basis for development. We would not have American merchant marine, nor would we have given our citisens the opportunity to develop and organise the business of shipbuilding and ship owning. On the other hand, we would have simply hired foreigners to perform this work in a slightly more expensive manner than they are performing it now, for a military purpose which cannot commend itself as a necessity.

Why Kill Our Shipbuilding by Free Ships?

A ship is probably the most elaborate and complex product, and includes within liself the application of the best skill in more mechanical trades than any other single construction which the world uses. Therefore, it is difficult to understand why the art of ship-building should be selected for extinction by the application of free trade, when it is probably intended to permit other manufacturing industries to continue to live, it might be fair to treat ships on the same tariff theory on which yes are considering other spanishactures, namely, to apply an import duty based upon the difference in cost and regulate it from time to times as required. At the present time it would probably be necessary to establish a duty of about 1840 a gross fon on to built cargo steamers and 850 a gross fon on combined freight and passenger steamers. The application of duty per ton, which is a recognised and established system of measurement throughout the world; would prevent the dumping in this country of second-hand, worn-out vessels, and it is desirable from that point of view.

The experience of foreign governments with a free ship policy is instructive. Great Britain is often cited as a bright and shiring example. But Great Britain did not adopt free ships matil 1848, or, in effect, and the ship of the ship is ship of the ship of the ship is ship of the ship of

France, in 1881, after a jong trial of free ships, found herself with a smaller tonnego \$14,000 then

The state of the s

set in 1870-1,072,000 tons. Resnwhite French positions had been so nearly destroyed that it was smilt to maintain a decent war feet. This experi-giously France to a subsidy policy, under which merchant shipping has increased from 914,000 to n bed in 1870 the discrimant shipping has increased from 914,000 to 1,560,000 tons. German, while raying on free ships alsow, fearcased its tennage only from 1,089,000 in 1977 to 1,560,000 in 1881. Ships were bought in 1978 to 1,560,000 in 1881. Ships were bought in Sagisdad Seng enough for German engineers to learn the art by access to the best plants, and then, under the leadership of Himmarck , a vigorous policy of impactal protectionism was submarked on in the form of wall subsections and other state to retain the continuous contents. bventions and other aids to native shipbuildmali su ing, with the result that German tonnage grew swiftly sine, with the result that German transage arew swiftly from 1.044,000 to 4,000,000 now. Norway is often pic-tured, as another bright example of free ships; but Norwagian tomages since 1881 has not increased so rapidry as Prench tennage, and Norway of late years has been applying a minkely policy of its own. Japan ried nothing but free ships until 1894, with the result that it had then only 500,000 from of merchant ship-olug. The war with China forced Japan to turn to pulg.

national aid, and Japanese ships have grown more swiftly than those of any other nation in the world, or from 200,000 tons to 1,544,000. Japan gives bounties to native shippards and subventions to regular lines.

Free Ships Should be Offset by Bounties to Native Ships.

To grant free ships without any direct aid to home To great tree sains without any nites at to homes shipyards is a policy abandoned now by all maritime governments. Those nations that allow their people to buy ships abroad either impose a tax on those ships when naturalized, or forbid the subsidizing of those ships, or grant bountles to ships of native con-struction. These other governments realize that no struction. These other government has ever succeeded as an owner of ships that was not also a builder of ships, and that to depend upon ships built abroad is to strengthen the resources of the competitor that builds them and to postpone the day of successful competition

It has been the endeavor herein to make clear that is an seen the emeavor herein to make clear that free abilts will operate undoubtedly to the disad-vantage of American labor and also will retard the acquisition of actual see power by the United States. The development of American shipping and shipbuild-ing can only result from the same kind of encourage-ment that has been given by the novotactic staff for is been given by the protective tariff to ment that he other manufactures.

American shipbuilders on the coast can expect to reduce their costs of construction only by the orgaukzation of their business which is possible by con-tinuous work on vessels of similar types. This has been the experience on the Great Lakes, where large numbers of vessels of similar construction have been built for bulk cargoes at a low cost after the business had become organised by experience.

has become organized by experience. The coast shipbulders have insufficient work for their plants and work so various in character and variable in quantity that their organization is unduly expensive and their labor inefficient.

The Current Supplement

A LMOST exactly three centuries have passed since Kepler discovered the laws of planetary motion. The simple and ingenious empirical process that led Kepler inevitably to the discovery of the true form of planetary orbits is not generally known. This process is described very clearly in the opening article of the current Suprezement, No 1843. Madame Curie s in detail how pure radium chloride is separated from the barium chloride with which it is a clated. The French Senate recently passed a law which was approved by the Chamber of Deputies fourwhich was approved by the Chamber of Deputies four-ten years ago, and which will make the legal stand-ard time in France 8 minutes and 21 seconds slower than Paris mean solar time. The reasons for selecting this interval of 9 minutes and 21 seconds, the reser-vations by which a complete and formal adoption of the meridian of Greenwich has been evaded, and the advantages and disadvantages obtained, are admirably discussed in the current Surrisassers under the title, "International Standard Time." The fourth instal-ment of Mr. Walier' V. Turrer's, splendid paper on "The Air-Brake as Related to Progress in Locanotion" is presented. A life-swing service for the reacue of miners in time of disaster is the first important step lakes by the United States, Barreau of Miness in an by the United States, Bureau of Mines in an to reduce the appalling loss of life in American rt to redu effort to reduce the appalling loss of life in American coal mines. The service is described in an excellently illustrated article. The distinguished German bloi-quit August Weismann, writes on Charles Darwig, Rr. A. D. Morohouse, Office Engineer, Drainage Travetigations, contributes at interactive paper on "Dist Escalamation of the Southern Louisians Wet Printle, Lands." Under the tilts, "Togosina and Ganoties," Bid. G. Ciurko Nuttail presents a thoughttal article be. Mr. G. Clarke Nuttall presents a thoughtful or

Correspondence

WITH particular pleasure the Editor inserts the VV following letter. It is timely, as the expression of an opinion opposite to some of those embodied in Mr. Bosoles's able article; moreover, in his concluding sentences, Mr. Noble sounds the keynote of the respondence columns. We believe that they should be, and are, a "most effective method of education." The Editor makes no claim for infallibility, either in his selection of material or in those pen-chats which known as the editorial columns. He gives you his deas, and asks for yours. If you have opinions on current topics which you think will be valuable to the Don't be too hursh a judge your own literary qualifications. Many an acceptable writer has discovered himself as the result of a letter, written with much difficance to the Edstor, that was

vertisen seith much apparence to the Latter, that tous published with hearty approval.

Bo let it be understood that, if you have something worth while, which you would like to say to the hundreds of thousands who read the Scientific Amurcan, re invited to send it in for our sympathetically critical reading.-Epiros

The Merchant Marine and Preferential Duties

To the Editor of the SCIENTIFIC AMERICAN: As I have already occupied some of your valuable space on the subject of our merchant marine, I do not feel entitled to any more in response to your invitation to discuss the subject. I should, however, be pleased

know that you have considered the following:

I do not feel at all certain that preferential duties will work as well to-day as they did prior to 1810, nor am I convinced that the preferential duties were the real cause of our prosperous ocean carrying trade at that time It seems to me that it was due vastly more to the fact that European wars were keeping European merchant vessels from competing with us, and perhaps even more to the fact that there was then no high protective tariff to make the cost of labor much greater here than in Europe. As a matter of fact, did not our shipping industry continue to prosper (in the main) until the passage of the Morrill Act in 1861? And is not its decline almost exactly proportional to our prosperity in the inland protected industries?

objection to preferential duties, it seems to me lies in the fact that they will not apply themselves directly to the object sought, and to that alone; also that they will tend in many instances to build up our shipindustry in the least desirable directions and fall to build it up in the most desirable directions Thus, a five per cent remission of duties will en-courage American vessels in the carrying of those commodities only on which we have a tariff, and probcommodities only on which we have a tarif, and prob-ably on those only on which our import duties amount to the most per ton. For it is not to be presumed that foreign nations like Great Britain are going to let us capture all or the bulk of their carrying trade even with us. If they let us regain our share (one-half) we should be well satisfied. But the trouble with preferential duties will be that they will en-courage the carrying in American bottoms of practically all the imports from just such countries as England and Germany, because the remission of duty per ton on such high-class products as come from these countries will be most tempting to American vessels, while it will have practically no effect on importations from such countries as Canada and South America. Hence, instead of finding a market for our manufactured products, which is what we want, we shall be providing a market for foreign manufacturers,

ist what we do not want. Likewise, to those countries from which w import more high-class commodities, viz, European countries, we should also export low-class com-modifies like cotton, wheat, and corn For in order to get the full benefit of the remission of duty on the to get the tail benefit in high-class commodities from Europe, our American vessels would be compelled to go to those countries laden with such commodities as those countries will purchase, which will be the low-class commodities named, and the competition for the carrying of these commodities would have its effect in increasing their export. We would then be in the foolish position of having one law (Canadian re-ciprocity) to encourage the importation of these commodities and another to encourage their exportation'
Again, the European countries from whom we would

thus take the carrying trade (if they took no re-taliatory measures) would be compelled to seek South taintory measures) would be composed to seek south a American trade, for their veasels, and in so doing would even more rapidly than now develop valuable commercial relations with those countries, the very countries about which we ought to be the most so-

But we may depend upon it that European countries will never stand idly by and allow us to manipulate

things in this way. They will retaliate, with the effect that our remission of duties will represent so much money dumped into the ocean, with no permanent effect in building up our own merchant marine.

Instead of intruding our vessels into European ports where they are not wanted and for a trade that we do not want, let us devise some means for securing berths for them in South American ports, where we have a natural right and will have a hearty weie, and let us encourage the trade that we do want, and must make some special effort to secure, and thus increase our influence where it is alike most needed and most profitable to us. Why build the Panama Canal, and then pass laws that will practically forbid American vessels the use of it?

Finally, it is a humiliating comment on American intelligence that we can be induced to pay indirectly for a thing that we will not pay for directly. What we want is to receive considerable education in the matter of our duty as a great world power, whose liberty-fostering institutions are destined to leaven the whole lump. I congratulate you upon having adopted one of the most effective methods of education, that of taking the people into your confidence and inducing them to study this subject and to ex press thomselves I certainly hope that you will be oded with as many and as opposing views as this country can produce and you can find room to print Hettinger N D

Stability of Cofferdam Around the "Maine" To the Editor of the SCIENTIFIC AMERICAN

I noticed in your paper a publication of the general outline of the cofferdam which it was proposed by the United States Government to build around the wreck of the battleship "Maine," and it seems to me that there are two points of possible failure of a structure of this kind which have not been discussed.

One is the fact that each of the single structures is an aggregation and not a unit, and that failure is liable owing to the lack of frictional resistance beeen each of the individual piles, and it seems failure is possible by the structure collapsing like a

failure is possible by the structure collapsing like a line of blocks, each pile sliding on the other. Second: It seems that if sufficient frictional re-sistance between the piles is provided by riveting straps across the piles, loining them together, there is danger of collapse of the inside toe of the structure, is danger of collapse of the Inside too of the structure, because of the lack of longitudinal support of the individual piles at that point. For illustration. If we take an ordinary tin can, such as iomaloes or other vegetables are preserved in, and cut the head out of one end of it, then place this can on the floor in a vertical position, if weight is placed upon the can and the same is slightly tilted, the portion in contact with the floor will collapse.

This seems to me to be the position of this coffer-dam, particularly in view of the filling which is being used in the cylinders, which filling consists of soft mud, which is pumped into the cylinders and which must remain for some time in a semi-fluid state, thus offering nothing in the way of resistance to longitu-dinal pressure. This condition might to a certain extent be improved if the filling within the cylinders was made of a mixture of clay and fine stone, which or some reason seems to form a very solid mass. In a case in my own experience, where clay was

being used to stop a leak in a cofferdam where timber was placed against an inclined ledge, the clay failed utterly until a certain amount of finely broken stone was dumped in, then the mass became very firm and all leaks were permanently stopped; thus it seems all leaks were permanently stopped; thus it seems to me that a mixture of this kind would increase the stability of these cylinders Certainly if the cylinders with their filling were monolithic and the foundations under them firm, there would be no question as to their efficiency; but the further they depart from this condition the more liable they are to failure, and therefore it seems to me that every reasonable effort should be made to approach this condition as nearly as possible. New York, N. Y

E C Moone C E

How Deserts are Formed

THERE is a popular idea that deserts like the Sahara are the bottoms of ancient seas which have been lifted above their original elevation by geological forces. This notion is an erroneous one it is absolutely certain, high authorities contend, that the sands of all the great deserts have been formed on the spot by the disintegration of the solid rocks on which they rest. Desert sands correspond in all respects, so far as their mode of origin is concerned, to the dust and sand that accumulates on our high roads in summer All deserts are situated where the winds from the ocean, before reaching them, are exhausted of their moisture by passing over mountains or across extensive tracts of land.

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

The Traffic Problem in London

A STATE OF S

THE third annual report of the London Traffic Branch of the Board of Trade has just been issued as a blue book, dealing among other things with the very serious problem of coping with the ever-increasing traffic of this huge city.

The defects of the existing roads are set out in some detail, and suggestions are made as to what measures it would be desirable to take with a view to making good the deficiencies and generally to e main thoroughfares up to the require ments of present and prospective traffic. A resume of the principal points brought out in this blue book is given in a recent issue of The Engineer, and is reoduced in part below, together with two accomp

in the first place reference is made to the increase in population in Greater London, and the fact is re-called that while the population in that area increases as a whole year by year, the increase is larger in Outer London than it is in the Adminissible counts made at different points on the same road were made on the same day.

were made on the same day.

The report lays stress on several points regarding these two censuses. The first is that as each particular count was made on a single day only, it The volume of traffic varies from day to ed by many circumstances, apart from the season of the year. Still, every precaution was taken to choose days for the counts which were unaffected by abnormal happenings. Then, again, it is pointed out that mere numbers do not serve as a measure of the degree of obstruction caused by vehimeasure of the degree of obstruction caused by web-cles of different classes. For lastance, the number of vehicles of all classes that passed flow Bridge and Stephend's Bush were found to be practically the same, but reduced to a common standard the traffic at Bow Bridge was found to be the heavier in the proportion of 4.6.7 to 39.8. To arrive at some uniform basis of comparison, therefore, it became necessary to find a "Traffic Unit" in terms of which every vehicle might be assigned a coefficient, which might

oughfares ought not to be regi-erdinary traffic, and in such all treated as part of the readway.

In laying out the width of an arterial read don it will, it is stated, he necessary to ado ards considerably in advance of these that cepted as sufficient in the past. Where the fre must be made for standing and slow-moving w which practically take up the width of a single line of traffic on each side. In addition to these two, and of traffic on each side. In addition to these twe, and to the space coupled by transways, an artiglal road should be wide enough for at least two lines of her-ing vehicles on each side of the tram lines, in order that fact traffic may pass unclessing at hormal speed. Thus the roadway of a main theroughfare with slope on both sides ought to accommodate a desired the transway and six lines of cordinary traffic—three or each side. In extrume cases it may even be accommany to allow for four lines of traffic on each side. suming that each line of traffic requires 8 f. inches, and giving a corresponding width to the fe

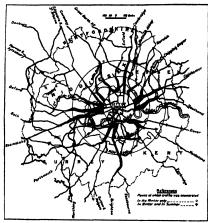
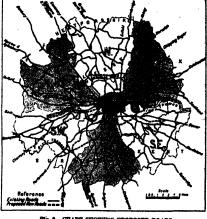


Fig. 1.—CHART SHOWING DENSITY OF TRAFFIC



Pig. 2.—CHART SHOWING PROPOSED ROADS

trative County According to the estimates of the Register-General the population of London in 1910 amely, 7,537,196—showed an increase over the population in 1909 of 107,486, of which 38,748 is attributable to the Administrative County and 68,708 to Outer London—equivalent to percentages of 0.8 and 2.70, respectively. This fact, it is pointed out, has a direct bearing upon traffic, inasmuch as it implies a growing demand for traffic facilities of a kind differing from that which would be required were the incres uted evenly over the two areas.

The longer the delay to take steps to widen and improve the arterial roadways of London and to make new roadways, the greater will be the expense of carrying out the necessary work Before taking any steps, however, it was necessary in the first instan to obtain an accurate idea of exactly how dense the traffic was on the various main roads leading from the metropolis The London County Council, which has a staff of men specially trained for this work, was approached and undertook to take the census A classification of vehicles was settled by consultation with the statistical officer of the Council, the points at which it was desirable to count the traffic were selected, and the first census was taken between January 3rd and February 18th, 1910 To measure the difference in volume and nature between the winter and summer traffic, a second consus was taken be-tween June 6th and July 22nd.

The results of these two counts are shown diagram-matically in Fig. 1, in which the width of the dark-shed portions indicate the relative density of traffic. It will not be necessary to go deeply into the details of the census, further than to say that as far as poscordingly the following classification was adopted:

Trade Vehicles.	Passenger Vehicles.				
1 Horse (fast)	3 Electric trams16				
1 Horse (slow)	7 Omnibus (horse) 5				
2 Horse (fast)	4 Omnibus (motor) 3				
2 Horse (slow)	10 Cabs (horse) 2				
Motor (fast)	2 Cabs (motor) 1				
Motor (slow)	5 Carriages (horse) 2				
Barrows	6 Carriages (motor) 1				
It is explained that this	classification can only be re-				

garded as approximate, since the various only be re-fer among themselves. Still, it is a basis to go on, and it is that which has been used in the preparation of Fig. 1.

The roadways in London to-day are, as a rule wider than they were a hundred years ago, and in the meanwhile encroachments have been suffered to grow measurable encroacements have been surered to grow up which have added greatly to the difficulty in widening. "There is now," says the report, "not a single road leading into London which, in some parts of its course, is free from serious defects, arising either from the conditions of the road itself, or from the volume of traffic which it has to carry. Within the volume of transp which it has to carry. Within the last few years, owing it to the great increase in the population, especially in Outer London, to the introduction of electric transpars, and, more requisity, to that of motor trashe, the use of the reads has inreased to such an extent that all the main spyring-her to London are overtased, and the situation which existed prior to the advent of railways has these interest introduced in an aggressived form. "The report consideration that the space coupled by train lines in buy," they

have a relation to its size, speed, and flexibility. Ac- ways, the figures given in the following table are

arrived at:							
1	Road	dway. Footway.			Tot	Total.	
	ft.	in.	£.	in.	£Ł.	in.	
Two tramlines and four lines of traffic on each							
side	85	0	40	0	125	0	
Two tramlines and three lines of traffic on each						Ĭ	
side	68	0	32	8	180	0	
Two tramlines and two lines of traffic on each							
side	61	0	29		80	9	
Two tramlines and one line of traffic on each							
. #ide	84	0	20	0	54		
Three itses of traffic with-				,			
out tramways			17		42		
These dimensions save	+2-	-				_	

anase dimensions, says the report, are obvious subject to variation, but they serve to show the with that should be aimed at, and point to the follow standard of widths for roads of different classes in

radiating or connecting places of importance 75 feet to 10 ad-chas county reads \$0 feet to

Second-class county roads.

Pirst-chase district reads, connecting villages or forming president of mein county reads.

Second-class district reads, meaning the county reads. country hases
Having arrived at this should be the

ASTOR OF STREET

The tax takens in the reads redicting the form of the current and the current spin of the mistropolis. The suggested improva-sult size the new reads are for the most part shown a spin size the new reads are for the most part shown a spin should. The most important of the new reads required burght size the Eastern Avenue 164 miles to Wastern Avenue 131 miles, the North Circular and, 38 miles, and the Cherkey Road with its ux s, 11,5 milles. The sugg stion is to make in all sof new road and to improve 25 45 miles of 99,9 mf med, making a total of 125.85 miles

The construction of several new bridges and the raction of some existing bridges are included in the suga

bing on these figures the report says that t providing 100 miles of new roads, and of im 25% miles of existing roads within the Metro cost of provid sa. In addition to extensive widenings of or existing roads would of course be very large, it continues "it is difficult to see how it can be but, ft or ded if congestion is to be relieved and propavoided if congestion is to be relieved and proper provision made for the needs of the future Large as the expense may be it should be remembered that the cost of teaction is also heavy. The time lost daily by mil lions of people through insufficient road accommodation is alone equivalent to a loss of money which though impossible to estimate with accuracy must be very large. It should further be borne in mind that er the improvements are postponed the more

Applications of Chemistry to Public Welfare

A MOST interesting and valuable survey of the es-sential aspects of the work of the Bureau of Chem intry Department of Agriculture has recently been given by Dr Wiley on the occasion of his acceptance of the Eilliott Cresson medal conferred upon him last December The uninent chemist said in part

"One of the first investigations undertaken in the retim of agricultural science was a study of the con servation of and waste of plant food. Long before the present vogue of conservation came into existence important studies in the conservation of plant food were planned and executed. These studies were crys ware passesser and executed. Takes status were crystallised in two addresses ellywared the one in 1886 before the Chessical Section of the American Association for the Advancement of Selence on The Sconemical Association (Agricultural Chemistry and the other as presidential address before the Americas Chemical Society in 1893 on The Waste and Conserva In the summary of the data in the address on the economical aspects of agricultural listry the following statements are made

" Future Food Supply -Since with a proper econ the natural supplies of potash and phosphor sold may be made to do duty over and over again, and finitely the economist who looks to fare of the future need have no fear of the failure of these resources of the growing plant Indeed, it may be said that the available quantities of them may be d by a wise practice of agriculture based on

the teachings of agricultural chemistry

"But with the increase of population comes an in
creased demand for food and therefore the stores of available nitrogen must be enlarged to supply the demands of the increased agricultural product. It is cortain that with the new analytical methods many series of experiments will be undertaken the out come of which will definitely settle the question of the entrance of free nitrogen into vegetable tissues. If this question be answered affirmatively agricultural science will not place bounds to the possible produc tion of foods. If the nitrifying process does within the cells of plants and if living organism fix free nitrogen in the soil in a form in which at least a portion of it may be nitrified we may expect to see the quantities of combined nitrogen increase i passe with the needs of plant life

"Thus even intensive outture may leave the gardens and spread over the fields, and the quantities of food stemance of the human race be ble for the su mounty increased

"Among the closing paragraphs of the address on the waste and conservation of plant food, are the fol

lowing: "Through the ages of the past the rich stores of plant food have been steadily removed from arable fields and apparently forever lost. But in point of fields in particle of it has been destroyed. Even the destrictions formed to be first agent of the first particle of the first

ble ferments herding in the rootlets of legumes and other orders of plants are able to recover again make available this loss.

"The fact that a few million years may supervene before the particle that is carried off to-day as waste may return to organic life shows the patience rather than the wastefulness of nature

As a result of this general review of the migra s of plant food the reassuring conclusion i tions of plant fo reached that there is no danger whatever of the ulti-mate consumption or waste of the materials on which Circumscribed localities through care plants live leasness or ignorance where once luxuriant crops grew may become sterile but the great source of sup-ply is not exhausted. In fact as the rocks decay and nitrifying organisms increase the total store of plant food at the disposal of vegetation may continue to ow When we join with this the fact that the skill man in growing crops is rapidly increasing we find no danger shead in respect of the quantity of human which may be produced

It is evident that plants like animals cannot without proper care and food is just as im nortant in the development of high grade plants and indant crops as it is in the production of high grade cattle and sheep. The soil was regarded for many centuries as dead matter containing certain stores of plant food but one of the first things ob in these investigations which were mad that soil is a living body and as such entitled to have a hygiene and physiology of its own The study of the soil thus becomes not alone a problem in mineral chemistry but a biological problem of the highest in portance and significance In the Bureau of Chemistry made the first systematic studies in this countr of the organisms of the soil which produce nitric acid

Elaborate experiments were conducted in a series of pet cultures to establish the conditions of maximum activity of nitrification and the relative nitrify ing power of different soils, samples of which we taken under such conditions as to insure normal bacterial activities These led to the important ob-servation that the chemical composition of plants n mature was influenced in the most remarkable degree by the environment to which they were sub-jected and that the influence of the soil in determin ing the quality of the plants was far less significant

than had usually been supposed
"An extensive investigation was undertaken on the infine sence of environment upon the composition of at and other cereals, upon the production of the maximum amount of sugar in the sugar beet and upon the distribution and qualities of the best vari eties of green sweet corn cantaloupes and other crops The plan of investigation followed in these studies is pears original and has now been very closely od in Australia and some other countries Briefly the plan of study was to distribute the same ed in widely different localities and have these seed planted and cultivated in as nearly as nossible the same manner After being properly harvested and cared for the crops were chemically examined and compared with crops grown in the mother is evident that in this way the differences in compowere not due to any inherent properties that is due to heredity but to the forces of the environment under which the crops were produced. Several elab orate monographs have been published on this subject and among these the one of the greatest eco-nomic significance is the result of the studies, covering more than fifteen years on the effect of the environ ment upon the production of the maximum quantity of sugar in the sugar beet. As a result of these pro-longed studies a biological map of the sugar bee area was constructed indicating by a shaded band stretched from the Atlantic to the Pacific those areas in the United States where the richest sugar beets The practical b would be likely to grow study is shown in the fact that many intending in ors who were about to place their capital in beet sugar enterprises in unpropitious localities were de ed from doing so by the results of these studies and thus hundreds of thousands of dollars were saved which otherwise would have been squandered most remarkable practical demonstration however of the value of such studies from an economic point of view is in the fact that practically every beet sugar factory which has been successful and which is now operating is located in the shaded belt marked out now almost fifteen years ago out now almost niteen years ago. The studies of all the factors in the production of a sugar beet of maximum sweetness has led to the conclusion based maximum sweetness has led to the conclusion based upon indubitable data that the dominant factor is a upon industrible data that the dominant factor is a long day and a undersate temperature, not varying very much from an average of 70 deg F for the three growing mantis, of June, July and August. It is evi dent, therefore, that a high northern latitude com bined with a paper distribution of water by irrigation or otherwise is the only place where a sugar best can be grown at the present time which can compete with European grown sugar

nese are only some of the more important of the many biological investigations which have been con ducted in connection with the growth of crops and the increase of the food supply of the country activities of the Bureau of Chemistry however have not been confined to plant life The highest service of science is to man himself and the welfare of the plant and of the animal from an ethical moral and momic point of view may have their highest sig nificance in their relation to the welfers of men this end a great deal of the energy which has been expended in the investigations of the Bureau of Chemistry has been directed to problems involving human rights the health of the people and the honesty of trade

Under the old principle of the common law the pir chaser himself was held responsible for investigating the character of the goods he bought and this led to the maxim of the common law of neat mpt r
The statute of law however recognizes the helplessness of the purchaser in most cases to make such in vestigations and so under this law the legend has become coveat vendor Especially is this true in respect of those who by reason of a tender age are incapable of looking out for themselves In the case of infants foods the duty of the State and municipality is plain The only artificial food an infant deprived of its nat ural food should have is pure fresh milk modified to be as much like mothers milk as possible Fxperience has shown that the death rate of artificially fe fants can be materially reduced by a pure milk diet What greater service may a municipality render its citizens than to save the lives of the children? It ems that the only immediate solution of the problem is the city-controlled milk supply for sick and mother less children The city should own its own herd of healthy cows kept in the best sanitary manner The milk should be handled by the latest methods of trans n and delivered promptly to the onsumer It should be made an offense of the law to feed a de ered infant under one year of age any food save the pure modified milk pure modified milk A charge equal to the price ordinary milk should be made for the minicipal milk which should be reserved solely for infents use

Effect of Radium Emanation on Plants

RADIUM produces by its spontaneous disintegra tion a gas which is usually called radium emana tion but for which Sir William Ramsay suggests the te miton derived from a Greek word which signi fies brightness Niton or radium emanation is a radio-active chemical element which disintegrates rapidly and has a very brief existence

Fabre has communicated to the French Biological Society the results of his experiments on the effect which the radiations of the emanation produce on germination and growth in various vegetable organisms. One of the organisms selected was black mold (Stengmatocystis nigra) The optimum or most favorable dose of radiation which developed the mold in four days was found to be $\frac{1}{12}$ microcurie per cubic centimeter of air (The curie is the unit of radio activity and the microcurie is one millionth of that The abiotic dose which kills the black mold is 1 microcurie or more per cubic centimeter

For the common white mold (Mucor nucedo) the optimum dose is 1 microcurie per liter of air. In the In the ase of Lilium (athartics m the dose most favorable for germination and growth is % microcurie per liter of air while this species of lily is killed by 40 microcuries per liter of air

A Device for Dummishing the Rolling of Shins

THE German engineer Frahm has devised a method of diminishing the rolling of ships which is the principal cause of seasickness. A water tank is placed on each side of the vessel and the two tanks are con nected by a pipe provided with any suitable devi e tive cross-section and the fri resistance opposed to the flow of water. In this way the oscillation of the mass of water from side to side can be regulated in period and phase so that it is opposed to the rolling of the ship which is thus diminished

According to the Retue des Non h the Frahm apparatus has been installed or two 1° 700 ton steamers of the Hamburg Ameria Conpany the tanks contain Ypiranga and the Corcorado TI 195 tons of water and greatly diminist the rolling for example from 11 degrees to 21/4 degrees on each side of the vertical In consequence of this success ful result the system will be installed on the new colossal vessel of the Hamburg-America I ine the "Europa." A similar device was tried on the British warship "Indexible in 1883 by Sir P Watts.

Curiosities of Science and Invention

Spring-driven Floor Smoothers

ONE of the most difficult problems of the builder is that of floor scraping, and it is of the utmost importance that the work should be well done, as there is nothing about an apartment or hall that stands out more prominently than the floors, which if well finished are very pleasing to the eye. A number of practipleasing to the eye. A number of practi-cal floor surfacing machines have been devised. The type seen at work in the accompanying illustration is provided with powerful motor springs which aid the operator in a most effective and sim ple way. The spring gathers tension on the forward stroke and furnishes sufficient power on the return or cutting stroke to overcome the back breaking pull experienced in the use of dead weight machines. There are two detachable weights used with the floor smoother, both weights being slotted so that they can be adjusted to bring any desired pres-sure to bear upon the scraper blade, the weights weighing about 150 pounds. A sand-papering attachment is employed with the machine, weighing complete 90 pounds without the scraper weight. The sander has a rounding surface and works with a rocking motion which auto-matically clears the dust from the sand paper

A Catamaran in a Suit Case

PARISIAN inventor has designed a catamaran which may be folded up into so small a compars that he can place it in a wooden box no larger than a suit case in fact, the case forms the tions of the case are secured end to end. ind by means of bolts and thumb screws, three cross bars are attached to the shell, with the outer ends secured to a pair of light wooden girders. A small seat is creeted at one end of the shell, The cigar-shaped floats of the catamaran are made of water-proof material, which may be packed into a small compass then not in use. In assembling the oat, however, the floats are inflated by means of bleycle pumps. The girders are secured to the floats by means of straps The paddle used with the catamaran is jointed so that it may be folded up and placed in the case weight of the entire boat is very small, and it is capable of fair speed. The inventor of this catamaran does not need to worry about boathouse privileges, for he can carry his boat with him to and

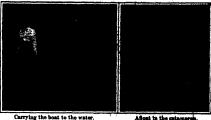
A Singular Motor Truck Accident

A REMARKABLE accident to a motor truck occurred at Reading, England, a while since The driver of the truck was endeavoring to true around in REMARKABLE accident to a motor somewhat close proximity to a river, when in some way or other he lost control of the vehicle, and more than half of the machine slid back into the stream, The driver and another man were both thrown into the stream, but fortunately escaped The problem of getting the car out of the water was a difficult one, but was successfully solved by placing a platform round the rear and then hauling it up on the supporting planks by means of a traction engine operating a pulley. Some idea of the difficulty of the business may be gathered from the accompanying photograph

Automobile as Horse-clipper

A MOST ingenious use for the autoinary surgeon of Portland, Oregon, who uses his little runabout as a horse-clin. * ping power plant Of course, this device has the double advantage of carrying him quickly to the place where he expects to operate and, once on the





Affort in the cutamare



Inflating the clumr-shaped finets



Recuing a motor truck.



length of ordinary bearing is used as a held consecutive wheel with the oligons. Then is started, and in about a ge

The Evolution of Ehaki ...

A LUCKY accident had so the inven-tion of khaid, that offve-colored cloth that is worn by soldiers.

For years the British treeps in India were a cutton cloth of a greenish brown, but it always fasted when washed with soap. While discussing this defect with some British officers, business man from England carelessly observed that the manufacturer first to discover the means manufacturer first to discover the means whereby a cutton grill could be made that would not fade would certainly make his fortune. One of the officers, a young man, took the hint. When he got been be employed a skilful dyer, and the two began a systematic search for an olive dys that, when used on cotton cieth, would not yield to soap or soda. They spent years in experiments along this line, but to no avail. The thing seemed

One day, however, they found among numerous scraps of dyed cloth one that retained its color under the most severe tests. The putaling part of it all was that this scrap had been derived from a piece of cloth that had been sub-jected to the same processes. For a long time the experimenters tried to solve this riddle. The one bit of cloth of khaki mentioned was the only piece that kept its color against all attacks.

Finally, by the merest chance, they hit ugen the secret. The dye in which this scrap had been dipped had remained for a time in a metal dish of a peculiar kind. This metal, in combination with the chemicals of the dye, had furnished the very thing needed. They made the axperiment with other pieces; the dye held, and their fortunes were made.

A Prehistoric Needle Factory

NOT so long ago much interest was covery of a prehistoric lake village near Glastonbury. The dwellings were placed on mounds of clay raised above the level of the water. The framework of a primi tive loom was found under one mound. the number of broken bone nee and bone splinters discovered in another mound led the explorers to think that if may have been the site of an ancient needle factory. Very few human bones have been discovered, but among the interesting finds is a blue glass bead, with a waving dark line running around it. One of the mounds contains three hun-dred tons of clay, all of which must have been dug from the surrounding hills, and carried to the spot in boats.

Tallest of Trees

I N New South Wales, Victoria and Tas-mania grews a species of gum tree, succeptus amygdalina, which probably represents the tallest of all trees of the

The loftiest specimen of this tree yet measured towers to the height of four hundred and seventy-one feet. A pros trate tree, measured in Victoria, was four hundred and twenty feet long, and the distance from the roots to the lowest branch was two hundred and ninety-five feet. At that point the trunk was four feet in diameter, and three hundred and sixty feet from the but the diameter was still three feet. The wood of this tree is hard and of good quality, it grows quickly, and yields a great quantity of whatile oil from its bares, which mes

The Heavens in May

Our Monthly Astronomical Page

By Henry Norris Russell, Ph.D.

IDELY as the stars appear to our eyes to differ in bright-

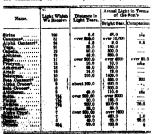
gree of brightness, we find, when we attempt to measure their distance, that some are enormously more remote, and hence must be chormously brighter, than others which look to us their equals. How great these difwhich look to us their equals. How great these dif-ferences are is well shown by the following list, which includes the brightness stars in the sky, which can be described with tolerable accuracy as of the first magnitude. All these have been very carefully observed for described the beautiful absorption and in most cases we bis:

make at least a good estimate of their distance.
Though some of them are
so far off that, even
though we have a baseline 186,000,000 miles long for our range-finding, the convergence of lines drawn from its two ends to the star is too small to

The stars are arranged in order of their apparent brightness in the sky in the second column. lowing the name of each star is given the amount star is given the amount of light which we receive from it (taking Sirius, the brightest of all, as 166). Next follows the distance in light-years, derived from the average of all available determinations of parallax (re-cently collected by Prof. Kapteyn). The uncer-tainty of the observed values is very different different cases. The few ten light-years are not likely to be, on the average, more than 5 per cent in error; but the perin proportion with the distance, those of 50 lightyears being subject to average errors of some 25 per cent of their value, those of 100 light-years to errors of 50 per cent, and those of 200 light-years and upwards being as yet with any certainty.

The last column gives the actual luminosity of these stars—!. e., the amount of light which they send out-our sun being taken as a standard. These are subject to a percentage of uncertainty double that which affects the distances.

As many stars are double, a second column gives the luminosity of their companions, many of which



are very faint. The pole-star, though well below the others in brightness, is added on account of its genothers in orderest.

THE BRIGHTEST STARS their real differe are yet greater. Even if we pick out a number which look of the same general de-

The diversity in the real brightness of these stars,

which look so much alike to us, is very striking, Canopus appears to us only twice as bright as Alpha Centauri, but really exceeds it several thousand fold. Rigel, which seems to us but one-sixth as bright as Sirius, is really something like a hundred times brighter. Its "faint" companion—shown by telescopes moderate power-which appears as a of light in comparison with Rigel itself, is really brighter than Procyon or Altair, and very likely exceeds Sirius in luminosity.

On the other hand, some of the nearer stars have

At 91/4 o'clock: April 30 NIGHT SKY: APRIL AND MAY

faint companions which give but a very small frac-tion of the sun's light. Such faint stars are not at -there are dozens of them known to be within 50 light-years of our solar system-but even the nearest of them appear faint to us, and so do not come into a list of bright stars unless by the accident eing companions to a brighter primary.

The three southern stars which are bracketed together in the table belong to one of the remarkable star-streams discovered by Prof. Kapteyn. They are star-streams discovered by 700. Kaptou, here are all moving in the same direction, at about the same rate, as are many fainter stars in this part of the sky. From a study of these motions, aided by spec-troscope observations, it will soon be possible to determine the distances with considerable accuracy. s given above are only approximate.

CI the twenty-two stars of our list (besides the Pole-Star), eight are now well visible in the evening sky, and three more are rising or setting. Looking sky, and three more are rising or setting. Looking due west, sit the hour mentioned at the foot of the map, we find, Castor and Pollux close together and nearly on a level. Procyrol sesime distance to the left rand a liftle lower dewn, and Capella is a little driver away on the right. Below Castor and Pollux early in the westing we may see the red Betalgeux, st bright star of Orion to set.

The very brilliant object in the northwest, far ex ceeding any of the stars, is the planet Venus. She is steadily moving eastward among the stars—that is, apparently upward and to the left—from night to night. At the end of the month she is close to Castor

and Pollux, making a very fine group.

In the southwest and higher up is Regulus, at the end of the handle of the "Sickle," a group of stars that can be identified at a glance. Far to the left, somewhat east of south, and lower down, is Spica Arcturus, known by his great brightness and yellow color, is high up, a little south of east

The very bright body in the southeast is the planet Jupiter, second only to Venus. Below him, and somewhat to the left, Antares is rising, and will become conspicuous in an hour or two.

Vega is low down, al-most due northeast, and Alpha Cygni is on the horizon, still farther to the left

these stars, or even a few of them, the map makes it very easy to trace out the other constellations, of which the most prominent are Cassiopeia, low in the north; Drace, high in the north and north-east; Ursa Major, almost overhead; Corona and Hercules, in the east, and Hydra, in the south.

In its enormous length, about one-fourth of the circumference the heavens, this huge constellation is indeed comparable to the fabled sea-serpent at its best It is not difficult to trace out a rather sinuous line of stars, beginning with a small but fairly conspicuous group about half way between Procyon and Regulus, passing southwards to an iso-lated bright star, Alpha Hydre, sometimes known by the name of Alphard, and running on its line, sometimes marked by faint stars, below Spica, almost to the border of Scorpio
On the back of this

serpent stand two utterly unrelated objects, a Cap and a Crow. Both are ancient constellations, their names dating from classic times. The first is inconsulcuous. but con-

sists of a semicircle of small stars which bears some resemblance to a cap or bowl The second, Corvus, is fairly conspicuous, but bears not the slighest semblance to a crow, its principal configuration being an irregular quadrilateral of stars of the second and third magnitudes, whose northern side points almost straight toward Spics

Observers south of 28 deg north latitude—that is, in Florida, Southern Texas, and southward—can at this season see the Southern Cross, low on the horizon The Cross is almost exactly south of Corvus, and is best seen when this constellation is on the mendian beek seem when this construction is on the melional adout an hour later, when Spica is due south, two very bright stars may be seen a little east of south, as low as the Cross, and pointing towards it Theone farthest east is Alpha Centauri, our nearest negative. bor in the heavens

THE PLANETS

is evening star -theoretically -- till the Mercury is evening star incorrence. The second of the when he goes through conjunction with the Sun, and narrowly escapes a manel, passing apparently within some five minutes of arc (or one-sixth the Sun's diameter) of the Sun's edge. He is visible to the naked eye only as a morning star at the end of

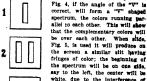


The Editor of the Home Laboratory will be giad to receive any sug-estions for this department and will pay for them promptly, if

Experiments on Light

By Sydney W. Ashe

I STERVERENCE.—The principle of interference of light rays may be prettily shown on a screen in a darkened room by means of the following simple apparatus. Obtain some ordinary lantern side glasses and cover them with passepartout paper, except the figures which are indicated in the illustration. No 1 is a single slit; No. 2 consists of two slits; No. 3 a set of "V" shaped sieps; No. 4 a wide "V." and No. 5 a wide silt These sildes should be placed one at a time in the silde carrier of a projecting lantern, and a carbon bisulphide prism should be placed before the objective lens Fig. 1 obviously will produce a single spectrum on the screen. Fig. 2 will likewise produce two spectrum, the violet of one spectrum be-In gadacent to the red of the next spectrum. Fig. 3 will produce a series of spectra, sach little square having its individual spectrum. Fig. 4, if the angle of the "y" is correct, will form a "Y" shaped



white.







Slides with vari-

SPECTRA OF ARCS.—If the objective lens of a projecting lantern is removed, a slit placed in the slide carrier, and the arc moved back, it will be possible to project the arc magnified many times on the screen. If a right-angled head lamp is used it will be possible to focus the crater on the acreen, and see the molten carbon in a state of ebuilition With the ordinary carbon are it will be noticed that no illumination is given off by the arc flame If a prism is placed before

the various colors, and on the other side, to the right, the other end of the spectrum will be found. The effect is as though the normal spectrum had been stretched out, the center being filled in with

the lantern when the objective lens is in place a spectrum will result, which approaches quite closely to day light. If a pair of flaming are carbons are used in the lantern and projected on the screen it will be noticed that the illumination is given off by the arc flame If the spectrum is projected on the screen the characteristic bands of calcium will ap-If a magnetite electrode is used in the lanters projected on the screen, it will be noticed that practically all of the illumination is given off by the arc flame, and it will produce a large number of narrow bands extending all over the spectrum forming

row bands extending all over the spectrum forming the characteristic scale for into the character of the It is interesting to note that the character of the negative electrode determines the color and lumin-osity of the arc. For instance, two kinds of ele-ctrodes such as a carbon and a magnetic electrode may be used, the inntern being connected through a reversing switch. When current is passing through the electrodes in one direction the characteristic spectrum of the material forming the negative electrode will be projected with a prism on the screen, and when the reversing switch is thrown in the oppo direction changing the polarity of the carb characteristic spectrum of the other carbon, the negative will be projected on the screen

. Accorry.—The tendency in all modern illuminating schemes is to keep the illuminant out of the field of vision, as it is found that an individual's ability to read decreases as the visual angle between the light source and the object decreases. For an angle of eight degrees an individual's acquiry is decreased

about thirty per cent. This may be prives amount mentally by sweeting a white chart on which is placed a small letter shout on-eight inch in beight, such as the letter "R." Huminate this chart with an exas the letter "R." Humbashs this chart with an ig-dinary andles or incandesonal lamy which is accretical from the eye of the objective. This constraint should be performed in a finitemed round. The justification about some informed invested the chart causal half-is-quite able to read the letter, and he should note his-distance from the chart. The cantle power of the light source divided by the square of the listance out the light from the screen will give the intensity of the light on the screen. Thus a 16 candle-power lamp





Arrangement of lamp and scree in visual acuity

4 feet from the screen will be 14/4°=1. When the observer has taken his reading he should light a small candle slougaide of the chart, on placed that it will not illuminate the chart, and then he should repeat his reading. He will find that it will be necessary to come much nearer the necessary to come much nearer the necessary to come much nearer the necessary to come foot candle by the name foot candle later when fifthminated by the name foot candle laterative.

Gopper Connections for Buttery Carbons. By A. J. Jarman

WHEN one attempts to make up a galvanic b William one attempts to make up a gairante back tory where a carbon plate or red forms the negative element, he must face the problem of forms the negative element, he must face the problem of forms in a good carbon connection with the electricity of the the statiure of a so-cathed dry besterp is due to the years of a good carbon connection of the problem of the p

piete success on as many as 44 cells coupled in series, as well as for the so-called dry or semi-dry list-tries. The principle has therefore been put theroughly to the test, and can be retiled upon. It consists in copper pitting the send of the carbon and soldering the connection to the copper.

The first thing to be done is to make a wedgen trough with as many divisions or cells as there are carbon piates to be prepared. Fig. 1 is a photograph of a small trough, made from a piece of board is inches wide, 10 inches long, and ½ inch thick, with strips of wood nalled upon the top so as to make four with shellac varsish twice, allowing the first coating to bocome set hard before the second coating is applied. Two good cells of a primary battery will be required (not dry orde); two Bunnels or a battery such as described in the Schrettry Ammony of My 28th, 1910. Now procure as many carbon plates auch as described in the Schertiff America, and May 28th, 1810. Now procure as many enfron plates as needed (Fig. 2 shows only four) and fit up served connectors with copper wire to a spring city at the top and a Ushaped copper strip at the bettom, and arrange them in the trough as shown in Fig. 2. An excellent size of carbon plate for almost any purpose in 7 to make long 2 to show wide and a 1/2 toph pose is 7 inches long, 2 inches wide, and a ¾ inch thick. Those shown in Figs. 3 to 5 are of this size. Now adjust these carbons as shown in Fig. 2, so that the current will flow from the carbon element

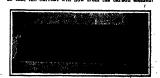


Fig. 1. - Trough in which plating to de-

of the battery through the wire that has a piece short copper soldered to it, so as to form the said of while the wire front the since dement of the said of the sa

existing has seened down, the modeling out to small short has coming that the lightery is also soon as the solution in press deposition of sopper will sale, and, of such carron plate. The allowed to cake place too rapid people of math carrier than The in-alliance to take place too build a to in regist because of too high a to liquid or the room, reduce the coal regist only. In the course of about

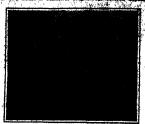


Fig. 2.—Carbons in the plating both.

of copper will be found all over the sad of the carbon plate. The battery connection may be undone and the carbon plates removed and dipped into hot water for a minute or two, so as to wash out the copper sulphate. Then the plates should be stood

oppear milphate. Then the plates should be stood upon milphate. Then the plates should be stood upon dicting page in a warm place to dry. Jose as soon as they are complistely dry, the coppered easie can be tinned by brushing a solution of calledde of sinte over them and applying a well heated copper bit or soldering from with a small heated copper bit or soldering from with a small can be done in haif a minute or less. In this contains the done in haif a minute or less. In this contains an extra decided a set of the set registriments can be attached by a good sold-tion as sittly of the contains and be attached by a good sold-to-self most now be well weaked in not water to get set of six y of the chiefle of size. As soon as the carbon has become thoroughly dry and cool it must let of six y of the chiefle of size, As soon as the supper district the paralim has crept above the supper district the paralim has crept above the coppered part, about haif an inch or more. Then remove the plates and stand it, with its joint downward, upon a place of board, and allow it to remain in this upon a piece of board, and allow it to remain in this position until the paradin has become set. When cold wipe off the excess of paradin with a rag wetted with ensine, and paint every part of the metal with shel-



Figs. 3 to 5.- Examples of plated and mounted of

ine varnish to half an inch below the joint.

In cells where salaminoniac, sulphate of ammonia or dilute solutions of sulphuric acid and the bichromates of potash or soda are used this form of connection is perfect, but it cannot be used with nitric acid a person, but it cannot so used with nitric acid selu-tions. In the course of many months working the elements may require a little scraping around the joint, and a second dipping in parasits, but such con-mections have been used in many betterless and lasted nections have never used in many betteries and nested as long as three years without any attention or repair. The carriage, elements for a powerful battery can be made up from the size described by soldering them the by side upon a copper base, and double or triple nts can be formed, so as to use two or m s in a single cell.

pieces in a single cell.

Figs. A and 5 show the carbon elements of cells made up from the plates described. Fig. 6 shows the combination of four carbon plates so as to give a weight combination of four carbon plates so as to give a weight contributed for a single cell, with adolfs in the wooden top to admit two sind plates, thus lowering the internal resistance of the cell confidentially. When the carbon elements of a battery are incommad upon a copper top or crown pieces a conjunct time for previously for fixing the carrier formation. The elements of the company to the company attachment. The elements drays as Fig. 5 is one of a last data without about pages.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Bushing Cigare by Machine

en His much sought for and hitherto a mantistand non-redistrible bottle has a successful counterpart in the tebacco Citar bands, to all practical in-and purposes, are non-reusable. of to seek individual cigar, and when a their is immobiled, it is almost reversally any of the common of and deserved. It is a comparison of the common of and deserved in the accomparison of the common of the c each cigar, for upon them he car build up a reputation for the quality of sods. The public has accepted, nay, parantee. It is not the only method of cotection open to the cigar manufacturer. Some brands of cigars are marked by burning a name in the wrap marked by burning a name in the wrap-per with a hot iron, but obviously the effloary of this method does not measure up to that of a paper band, chiefly be-cause R does not make as attractive a box of cigars. There is no doubt that a pleasing label exerts considerable in-fluence upon the consumer. In their endeavor to produce a cigar

it will prove acceptable to the smoker, manufacturers have been put to a great deal of expense. Not only are the bet-ter grade cigars banded, but also the r brands, and little cigars, and now even stogies are being dignified with a glittering mark of identification. Fully five billion cigars per year, or mixty per cent of the total output in the United es, are banded, and all this work must be done by hand. A veritable army

must be done by hand. A veritable army of girls is constantly ombjored at a cost of nearly two million dollars per year.

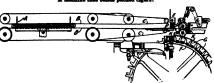
At first thought it would seem to be a simple matter to invent a machine that would wrap a band about a cigar and gum it fast. The task would be a very simple one did not the manufacturer than the statement of the distance of th have to cater to the dictates of the fastidious consumer, who must have his cigars put up in a variety of shapes and sisse. Indeed, the form of the cigar frequantly counts for more than the quality.
It is not enough that the cigars are round. They must be packed tightly in the box, so tightly as to be flattened by mutual contact, and herein lies the main obstacle to mechanical handling. The cigars are not all flattened alike. Slight ces in condition or in structure will cause one to yield more under the press than the other, and as a result we have a box of cigars molded together like the lobes of an orange, each vary-ing but slightly from the other in shape, and yet enough to make it next to imit has been disturbed and the comonce it has been disturbed and the com-bination logi. Now it would be imprac-ticable to hand the cigars before they are packed, because in the process of packing they would be crushed, distorted and broken, and would not fit sungry on the par, and so it is necessary to band the pars after they have been molded to the at the top. Then the cigars are a up one at a time, handed and rethe up one sh. a time, banded and re-infall to the very postlems they cont-infall to the ber. The marking through the machine. To remove the displactably in the ber. The marking through the machine. To remove the this winds, that work is done and the classes which which the bands are po-table to the control of the control of the control of the second paper. The class is the control of the la hearted and closed down upon the control of the control of

six thousand cigars in a day, and with tween them and the ends of the box. The conveyed clear of the pusher, the tray is such uniformity that not the slightest suca uniformity that not the slightest waver will show in the alignment when the cigars are placed in the box. The average speed, however, is about three thousand a day Rapid though this work may be, it is not rapid enough. Sometimes the bands are not put on required to the continue of squarely, sometimes they are not prop-erly gummed, or are put on too loose, and sometimes an unscrupulous operative will skip some of the lower rows of

box is then inverted and removed, leaving the cigars upon the tray. This is now placed in the machine in the position shown at the extreme right-hand end of the photograph. A pusher pushes the top layer of cigars, which, by the way, is the bottom layer of the box, between a pair of belts that serve to con-vey the bands toward the banding mechanism. This conveyer has a continuous motion and feeds the cigars to a second conveyer whose travel is inter Such conditions have been borne pa-mittent. The object of the intermittent tiently for all these years, because no motion is to separate the cigars by an mechanical substitute was brought forth, interval which will permit one to be Not long ago a successful machine was banded before the next reaches the band-constructed for banding loose, cigars, but ing mechaniam. At the banding point, the banding of packed cigars has been a the cigar is brought to a position over far more baffling puzzle. Aside from re-storing the cigars to their original po-sition, there is the variation of size and wheel which is for the moment station-

rt

A machine that bands packed cigars.



Longitudinal section of the

form of cigars to be considered. All of ary. whether of small diameter or large, and it will place the band in any position deaired upon the cigar. To avoid disturbing the order of the cigars, they are treated much as in the hand operation. The box is inverted upon a receptacle, from which cigars are taken automatically, fed to the banding mechanism and delivered on a platform at the other end of the machine in reverse order, so that they can be repacked in the box. While passing through the machine, the cigars are carefully handled so that there is no danger of injuring the wrapper. At the banding point the eigers are picked sanded by fashion. In order to up one at a time upon a suction tube saing the original order, the and deposited upon the open band, which is turned upside down and emptied is then folded about them by means of without touching the tobacce.

The accompanying sectional view ilrepresented by the degree from the box, a tray is used, in which they issue from the machine, which does not enlarge his right of proper per formed of a bottom and two guides, which which, of course, is the original order of representations of the product."

Thus, in the foregoing, the Court distinguished by As soon as one row of cigars has been thinguished between the right to manufacture.

The conveyer wheel is provided these difficulties appear to be mastered in with teeth that are adjustable so as to the machine shown in the accompanying form sockets of different sizes to fit different sizes of cigars. As soon as the cigar with the band is pressed into socket, two spring fingers operate to close the left-hand end of the band over the cigar. The conveyer wheel then rotates, bringing the right-hand end under a guide, which presses it down upon the left-hand end of the band. The right-hand end is either gummed in the machine or else, if gummed labels are provided for the machine, it is moistened previous to being pressed into place As the conveyer wheel pursues its intermittent motion along the guide, the gum face of the band lies against the bottom of the socket in the conveyer wheel, and hence it is necessary for the cigar to make a complete turn before it is deliv-After making a ered upon the platform. quarter turn, the cigar is delivered to a chute, which turns it through ninety degrees more, so that it issues upon the table face upward. Here an operator places the cigars in the box in the order in which they issue from the machine, which, of course, is the original order of

elevated sufficiently to bring the next This is row in line with the conveyer, and this is automatically pushed into the mechanism. Thus the cigars are fed into the

machine row by row until the tray is empty, when the mechanism automatic-ally stops, notifying the operator that it is time to place another box of cigars in the tray The operation of the machine is extremely rapid. It can do in one hour as much as a girl can do in an en-tire day. To be sure, it requires for its maximum efficiency two operators, one to feed the cigars and the other to repack them in the box. However, this work does not call for any particular skill, and hence is not expensive

Legal Notes

Price Pixing .- Mr. Justice Hughes of the Supreme Court has recently handed lown a decision in the case of Dr. Miles Medicine Company against John D.
Parks & Sons Company, involving the
general subject of price fixing. In the
decision Justice Hughes says

decision Justice Hugnes says:
"The complainant has no statutory ground. So far as appears there are no letters patent relating to the remedies in question. The complainant has not seen fit to make the disclosure remained by the statute, and thus secure. quired by the statute, and thus secure quired by the statute, and thus secure the privileges it confers. Its case lies outside of the policy of the patent law, and the extent of the right which that law secures is not here involved or determined."

The Court here and in other passages of the decision distinguishes between a product which has patent protection and one outside of such protection Court says

"The complainant relies upon the own ership of its secret process and its rights are to be determined accordingly are to be determined accordingly Any one may use it who fairly, by analysis and experiment, discovers it. But the complainant is entitled to be protected against invasion of its right in the pro ress by fraud or by breach of trust or contract."

Then again the Court, in distinguishing between the manufacture of the product and its commercial manipulation

"Here, however, the question concerns not the question of manufacture, but the manufactured product, an article of commerce. The complainant has not communicated its process in trust or under contract or executed a license for the use of the process with restrictions as to the manufacture and sale by the licensee to whom the communication is made. Complainant's secret remains in

The Court also says:
"But because there is no monopoly of the production, it certainly cannot said that there is no public interest in maintaining freedom of trade with respect to future sales after the article has been placed on the market and the producer has parted with his title More over, every manufacturer, before sale. controls the article he makes. With re spect to these, he has the right of owner ship and his dominion does not depend upon whether the process of manus ture is known or unknown, or upon any special advantage he may possess by location, materials or efficiency The fact that the market may not be supplied with the particular article unless he produces it is a practical consequence

ture and a party's right in his secret process as against fraud, and the right to control the sale of the product after the maker has parted with his owner

Now, as to restrictions of sales, Mr Justice Hughes says:

"But because a manufacturer is not bound to make or sell, it does not follow that in case of sales actually made, he that in case of sales settled when the many impose upon purchasers every sort of restriction. Thus a general restraint upon alienation is ordinarily invalid.

Nor can the manufacturer by

rule and notice, in the absence of con tract or statutory right, even though the restriction be known to purchasers, fix prices on future sales. It has been held by this Court that no such privilege ex-ists under the copyright statutes. although the owner of the copyright has the sole right to vend copies of the conveighted production

Further on the Court says.
The advantage of established retail prices frequently concerns the dealers. The enlarged profits which would result from adherence to the established rates would go to them and not to the com plainant. It is through the inability of the favored dealers to realize these profits on account of the described com petition, that the complainant works out its alleged injury. The complainant having sold its product at prices sat-infactory to itself, the public is entitled to whatever advantage is derived from competition in the subsequent traffic."

Associate Justice Holmes of Massachu-setts dissented from Justice Hughes's decision and Associate Justice Lurton took no part in the case because he had ren dered the opinion below

Patent Appeals.—The Court of Appeals of the District of Columbia on April 4th, 1911, handed down decisions in six patent appeals, three of which were ex parts cases and three inter-parts cases, and the decision of the Commis sioner of Patents was affirmed in all six

The Federal Reporter and the Courts -A minor feature of the new Judicia Code, but one which will have some in terest to our readers, is a provision to purchase sets and continuations of the Federal Reporter for the use of the courts and departments of the United States and of the Senate and House of Representatives The Attorney General is authorized to distribute these sets and digests at each place where a Circuit Court of Appeals or a District Court is now or may hereafter regularly be held. The clerks of the courts are to keep such reports and digests "for the use of the courts and the officials thereof." This measure has been pending before Con-gress for several years. The original bill was introduced at the request of some seventy United States judges. It received the hearty support of the Department of Justice, and was recom-mended by four successive Attorneys General—Knox, Moody, Bonaparie and Wickersham It was passed by the First Wickersham It was passed by the First at three times, and stood on the House when the House when the House when the Judiciary and the House when the Judiciary within for the House when the Judiciary within for the Pederal Reporter purchase was incorporated in the Code, where it purposes was incorporated in the Code, where it purposes was incorporated in the Code, where it purposes the House when the House when the House when the House when the purpose was incorporated in the Code, where it purposes was incorporated in the Code, where it purposes was incorporated in the Code, where it purposes when the House was the House when the House was the more than the most make the me proper was to prove the Judges with the former speedy termination of all classes and it is the thirty of the House when the House was the house of the House when the House was the House of the House when the House of the House when the House of the House was the House of the House when the House was the House of the House when the House was the House of the House when the House was the House when the House was the House of the House when the House was the House when the House was the Hou General-Knox. Moody. Bonaparte and

RECENTLY PATERTED INVENTIONS These columns are open to all putenties. Tr notices are inserted by speakl arrangement with the inventors. Torms on application to the Advertising Department of the SCENTIFF AMERICAN.

Pertendanting to Appaired.

GARKENT HANGER.—P. * **LAYMEN,
New York, N. Y. The more particular jutpose here is to provide a hangen having compartments for helding material for destroying
or driving away moths and other vermin. The
investion contemplates the addition of a longitudinal member provided with graduations is
order to adapt the device for use upon garments of watchus kinds and disaster.

Electrical Device

MOUTHPIECE.—Louis STRINBREGER, Brook-lyn. N. Y The particular purpose of the in-ventor is to improve the scoustical action of ventor is to improve the acoustical action of the mouthpiece, especially as applied for use in connection with telephone transmitters and the like, and to provide a form of construction that effectually prevents chipping or breaking energy of provitions of the mouthpiece, the con-cease of provitions of the mouthpiece, the con-cease of provitions of the mouthpiece of the deficiency and atrength.

Of Interest to Para

Of Saterost to Farmers.
IAY McKet.—I Harban, Le Resur, Minn.
This rack is adapted to be removably associated with vehicle frames and like structures, and has reference more particularly to the combination with a frame burdag a socket, or a rack adapted to be mounted upon the frame, and having a securing member adapted to serve the swelve and serving to hold the securing member in place.

of General Interest,
AUNILIARY HORMSHOE,—P. W. ZELLER,
24 Mathews Byred, Buffalo, N. Y. In the ordinary horseshoe, when it becomes wong, it is
necessary to take the horse to the bidtsmith
and waste a candidepuble amount of time is
order to replace the worn shores with zero ones,
An nighet in-this flaventing, therefore, is all
provide a detachable auxiliary shoe which can



AUXILIARY HORNESHOE.

he attached and detached in a remarkably short upper of time, and which still may be securely fastead to the hoof, so that it can-tured to the still still still still still still the horse cannot kick it off. The invention libratured herewith provides a shee with a realized body portion having shappend me-tallic projections embedded in the body per tion, adapted to engage the ground to prevent and the still still still still still still still still LINEMAN'S PRINNING UNPARKSYTE.

Linkman's Perinning dispersion to great a control of the control o

NIB.—Manyin & Tuange,
The invention relation to pens, PIEN Twans. The inventors require to pens, more particularly to supplementary-preserved; pinks, and the aim is to provide a non-desirable and easily operated pen min for use he pen manship. In the pen shown in the engraving the operation of the last flowing from the min.



point is governed entirely by the principles of capillary attraction or cohesion; and as the hit contained in the per does not appear on the suited of the same oxcept immediately as it is used, a pen is provided having a uni-form and consistent flow of ink.

Hardware and Twole.
TWIST DRILL.—R. B. Marzus. Rechester.
N. Y. This invention provides a critil where in the cutting are in reduced; provides a diffu-wherein is formed a central guide for the quantition of the tool; and provides a con-firmation. See a drill having a through contral product of the page of the pages of a glidge does remode in the metal by the drilling operation.

things and Machanton! Book Municiases and Michamban Bestess.

PROPELIES.—F. C. Goano, Asoth, Wash.
This investion relates to propelies having reversible blades so that the short, while turning continuously in one direction may be
made to drive the resuel about or saturn as
desired. The investion is an improvement
over a similar device disclosed in a prior
painnt granted to Mr. Gerdon.

Railways and Their Accessories

Bailways and Their Accessories.

CAR: FENDELL. J. P. GERGUIT and
GRORDE W. NATOR, Jorsey City, N. J. The
invention provides a fueder more sepecially
designed for use on cars of street railways
and the like, and arranged to normally stand
a distance above the track, so as not to interfere with awitches and the like or become injured in contact with the track, and to automatically move into a lowermest position
when striking a person or other object in its
trace and the control of the control
when striking a person or other object in its
takes preventing injury or
provide for protecting the fender in the case
provide for protecting the fender in the

Pertaining to Recreation

Pertaining to Recreation.
FIRH HOOX.—Jossers J. Munz.as, Gold
Rock, Ontario, Caneda. This invention refere
sore particularly to the combination with a
book having a barb, of a guard movable into
and out of juxtaposition with the harb of the
hook to render the same importative. The obsets of the invention shown herewith is to
provide a book which has a barb so that when



he hook to be withdrawn and quick the removal or mouth, which prevents in which renders easy and quick the renoral of the book from the mostly, which prevents in-jury to, the hook and unaccessing suffering, and which can be applied to be books of differ-rat types and sizes. Moreo-replaced by the Moras--replace of any of those placets will be from-land by the discussion, descended by the contract of Peaus with the institute of the phototes, ditte of the havenibles, and date of disc pages.

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This Assumida, Teal Book. A Record of Events and Progress. Edited by S. N. D. North, LL.D. New York: D. Appleton & Co., 1911. Sept. Set 1907.

Thirds, \$2.45 ag., 1917.

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ive thousand team rounds out the efficiency of the service of the

HANDBOOK OF AMERICAN INDIANS. Edited by Frederick Webb Hodge. Part 2. Washington: Government Printing Office, 1910. 8vo.; 1221 pp.; filus-trated.

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naminy No. 9243, -Wanted, address of maker of Engelyr No. 9434. Wanted, address of majurate

Inquiry No. 5946. Wanted, addresses of parties aring new Sectories, or minerals containing potent in

Thursday No. 1046. Wented the address of parties

A Painting in Glass on a C of Concrete

bright sky or a sheet of sunlit water. The painted surfaces reflect only a small por-tion of the light they receive, and in or-der to produce the effect of brightness, it is necessary to tone down and subduct the darker parts of the picture. In this the darker parts of the picture. In this respect the artist who paints with glass upon a canvas of coment has a distinct advantage. The light reflected by the glass is relatively so much greater that the colors of the darker portions may be reproduced in their natural tone. The beauty of the curtain cannot adequately be shown in the accompanying halforms reproduction.

reproduction. As nail-tone reproduction. As various lights are played over the scene the sky changes from a deep blue to a purple tone, while the sides of the mountains are resplendent with colors that are to be found only in the clear first amosphere of the west, while the water at the foot of the mountains undergoes remarkable changes from blue to bright green, and

changes from blue to bright green, and then to a deep purple. The theater in which this curtain is to be placed is being built of white marble. It will cover an area of five acres and will cost over \$8,000,000 in gold. A plea-ing feature of its design is the use of parch or the triangle of the purely obsastic.

The Heavens in May (Continued from page 481.)

the month, when he rises about 3:45 A. M., and can be seen before sunrise. Venus is evening size in Tarrus and Gemini. She is about 25 deg. north of the equator, and consequently remains in sight till an unusually late honor—about 10 P. M. on the lat and 10:30 on the 3ist. She is bright enough to cast a very conspicuous shadow when her light is adspicuous snadow when her light is au-mitted through a window to a white wall opposite. Telescopically, she appears like the Moon above three-quarters full, but, as always, shows no definite markings.

as always, shows no definite markings. Mars is morning star in Aquarius and Piaces, rising about 2 A. M. near the middle of the month. Jupiter is in Libra just past opposition, and is a splendid object all nister longs. From 2:24 to 2:28 A. M., and also from 3:36 to 4:18, Jupiter appears to have but the start of the planet, the second in front of it, while, the third is at first behind the planet and later in its shadow. This succession of phenomera. at first behind the planet and later in its shadow. This succession of phenom-ena will be of great interest to observers who have even small telescopes at their disposal. Saturn is morning star in Aries, too close to the Sun to be seen till the end of the month, when he rises at about 3:30 A M On the morning of the 28th he is in conjunction with Mer-

an about 5 of the State of the State of the State of 14 of the State of 15 of the State of the meridian about 4:30 A M in the middle of the month. Neptune is evening star in Gemini On the 29th he is in conjunction with Venus, but nearly 3 deg, south of her The Moon is in her first quarter at 8 A. M. on the 5th, full at 1 A. M. on the 5th, in her last quarter at 4 A M. on the 5th, and new at 1 A. M. on the 5th, and new at 1 A. M. on the 5th, and new at 1 he beavens she passes near Venus on the 15th, lare on the 15th, lare on the 15th, luranus on the 18th, Mars on the 22nd, and Neptune and Venus again on the 30th.

Princeton University Observatory Princeton University Observatory .

The Light of the Glow-worm

The Light of the Glow-worm

Of late the Franch entomologists have given much study to the glow-worm, natical much study to the glow-worm, natical results of the glow-worm, and the state of the light is such that both male and femule are luminous, although in the former the light is much feebler. Even the eggs and larve are faintly luminous. The light is produced on the last three segments of the abdomen.

It may perhaps be worth pointing out that the glow-worm is not a worm, but an insace blonging to the great order of beetles, the Coleopters. The mistaken name arises, no doubt, from the fact that the femule is grub-libs in form, without other wings or eityre, and so singularly (Constanced on page 487.)

Everyman's Car

The Brush Runabout

TWO qualities of the Brush Runabout make it an ideal car for women. These are its simplicity and its absolute dependability.

These qualities have been emonstrated publicly again and

agarn. It is so simple a child can run it—so dependable st ss a perfect business vehicle.

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In the hands of thousands of owners it has proven itself equal to meeting daily de-mands made upon it without mechanical difficulties of any sort at a minimum of expense.

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the style that my cars have, wouldn't disfigure one with a che lamp."

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without a high velocity, and the effect noted by a person steading by the side of the read.

(12440) F. S. C. anks: A little after 6 colored P. M. on March and 8 rd 10-served a somewhat peculiar phenomenon, and commented upon the same with several friends. Although the incon was only lithily crescuit, it is about like very much to see an account which would give a scientific explanation of this phenomenon, which I do not remember ever to have seen before. How is the optical cent of the seen of the seen of the seen of the seen of the phenomenon, which I do not remember ever to have seen before. How is the optical cent side of the moon appeared to budge slightly in the circumference? At least that was the appearance to my eye. A. The phenomenon to which you call our attention is the sew more area. It may be seen for a few days after new mone seek month. It is caused by the light which is reflected back toward the sum from the earth. This light two the server is the server of the seven the server is the failuly visible. When the moon gots older, the amount of light seet to the searth is of yeart that the dark part of the search is not in the attronomy," page 220) which we send for \$1.00 perspid. The apparent distortion of the edge of the moon would seem to be found it necessarily the search of the fact. It is the case with the writer now, but fact. It is the case with the writer now, but a contract of the fact. It is the case with the writer now, but a contract of the fact. It is the case with the writer now, but a stationary engine in any plant standing still standing still in the stationary engine in any plant standing still stan

mal eye does not see it in that way.

(13441) R. A. C. saks: If there be a

stationary engine in any plant standing still
for several hours, and it be a 150 horse-power
high-speed, 300 revolutions per misuth, and
ing down from the cylinder beneath the floor,
then turning with an L. steeding 10 feet,
then rising with an L. attanding 10 feet,
then rising with an L. 2 feet, then turning
with another L. into a pressure bester, then
with a rise of 20 feet. Now it the drain at
the exhaust pipe becomes stopped up, and the
enhant pipe heart the floor becomes filled
with water at a comperature of about 55 deg.
F., on starting the engine what would be the
stilled with water at a comperature of about 55 deg.
F., on starting the engine what would be
fine would start up, labor heavily, until the
water was bloom out of the enhant pipe, and
then rin as usual. There is a chance that the
cold water might condesse the steam in the
rilled in starting an engine with such a

so many times without sandson,
itself of the starting an engine with space has
no many times without sandson;
(13442) J. V. D. saks: What are the

(12442) J. V. D. askz: What are the main things or parts necessary to make a wine-less station capable of sending mountaged from hustern misses or over! How counts a 120-well official to used for wissless transmission?; d. The principal appareture for a transmission of the wine-sending station of the sending station of t

tuning coil, receiving condensus, and head staiphones. A 110-volt circuit on he med as many other for a native of current, and the support of the state of the support of the state of the voltage. Not collected as a 3-tilevent certific to meet all senditions of the atmosphere. You will find a 100-mile contit described in our SUPPLINEER FOR. 1000, 1822, 1822, 1824, 1825, and a 1,000-mile count of the state of the state

(19443) B. H. writes: In the article on constary orbits appearing in the Sourcery of Control of Provincia and Control of Control of

guarreling with each other. It all depends on how one looks at the matter.

4 (12444) S. L. asku: I have read with much interest an article on loads Radistion in many interest and the proof issue of January 21st. This has always been an interesting subject to me, and ospecially such as the proof of the house. One year of the house, the proof of the house, and is now on the market, that can be bought at a reasonable price that wood framish hast at a reasonable price that wood framish hast at a reasonable price that wood framish hast at a mapplement to the grifting of former than the proof of the proof of

this contray.

(12445) P. A. sales: How much higher than air is natural gas at one level'! Higher than air is natural gas at one level'! Higher than air is natural gas at one level'! Higher than air is natural gas at one level'! Higher than the level than than the level was a level to be interested. Would its ratising force be insreased in proportion to the pressure it would be subjected to! A. The principal constitution of hasternal gas in marsh gas, the specific glyinty of which is of long to the level than t







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unlike a typical beetle. The male, however, possesses both and files swiftly. ualite a typical bectie, and man, acsere, possessee both and files swiftly.
Luminosity among lasets indeed is
chieff found in the bectie order. The
Mexican fireflies (Pyrophorus), for exdesired found fireflies (Pyrophorus), for exdesired fireflies (Pyrophorus), for exdesired fireflies (Pyrophorus), for exdesired fireflies (Pyrophorus), for exdesired fireflies (Pyrophorus), for exwrite up his diary when wandering in
the South American forests.
In adult lift the glow-worm is a vaga-

the South American forests.

In adult life the glow-worm is a vegetarian, feeding on tender leaves of plants,
but while a grub it is carnivrous, feeding on smalls and sings. The light of the
glow-worm and flerdies has been called
phosphorescent and attributed to phosphores. Jousset the Sellezme has stated
his conviction that it is phosphorette

horeas. Journal of the phosphorested the southering his phosphorested the southering his contribution that it is phosphorested theses and in communication with the mercons and respiratory systems. Fabr. however, finds that phosphorus does not after into the composition of the luminous substance of the glowworm. Under the microscope it is seen to be a sort of white plaster covering the spiratory of the southern that the plaster covering the spiratory of the substance of the southern than the spiratory of the substance of the spiratory of the substance of the spiratory of the spiratory of the substance of the spiratory of the spi

and not yet over also to telestration.

According to Palarie's observation the light is easied by the supply of corygen that is under the control of the animals to the control of the con

by the animal.

However produced, it is said that the light of the Brefly and glow-worm is the most economical known. Economical, that is, in the sense that the greater part of the energy expended in producing it really appears as light. In the very best artificial system of lighting yet invented only a small processing or the anexes of arthetical system of lighting yet invented only a small percentage of the energy ex-pended on its production is turned into light, the rest appearing as heat and other invisible vibrations.

Plants That Like Cold

CLIMATE affects the inhabitants of the sea just as it does those of the land. As Arctic land-plants cannot down that the equator, so in the Arctic and Antarctic oceans marine plants are found that are unable to survive in warm

water.

Among the most remarkable of these cold-water plants are the lemineracce, a kind of sea-weed, which sometimes attain a gigantic site, exceeding in length the longest climbing-plants of the tropical forests, and developing huge stems like the trunks of trees.

Investigation has shown that these plants flourish in the coldest waters of the polar seas, and that they never additionally the season of the polar seas, and that they never additional than to the limite of "termmer temperature" in the ocean. The gunial warmth destroys them, just as a polar blast shrivels the flowers of a tropical garden.

Strange Ocean Chasma

LONG our Pacific coast there is gen-erally found a "platform," about ten

A LONG our Pacific coast there is genderally found a "platform," about ten
unles broad, solution away from the
above until it ropting away from the
above until it ropting away from the
above until it ropting rapidity.

The edge of this platform, it is avered,
is broken by twenty-eeven submerged
valleys, some of which are in line with
vivers entering the sea. But at least two
of them have mountains as the shove
signoits their backs, One of these
called King Peak Chaema, has the shove
sometimes. The ship ran on the rocky
coast and was look in food wrighter, when
the rocks could not be seen, it is beliewed that the adound vessel unknowlandy tollowed the line of the submerged
rolley or chaema, and her chysials, shellrolley the same, as and distance from
the country of the same and the registing of the
shellseed is was at a safe distance from
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the country.

Italian Aviator Killed.—While attempting a flight over the Seine at Puteaux, near Paris, on March 38th, M. Cei, an Italian pilot of a Biériot monoplane, lost control of his machine and was dashed to the ground from a height of 2,000 feet He was terribly injured and died a fee ours later.

Another Attempt to Fly from Nice to Consica.—The first stage of the proposed race from France to Algiers, i. e., Nice to Corsica, was attempted on April 21st by the Narquis Villeneuve on his Biériot nonoplane. He started at \$ A. M. on this 185-mile flight, but turned back on account of fog. The death of Cecil Grace and the marvelous escape of Lieut. Bague when attempting the same flight some weeks ago would make it seem that the Marquis used excellent judgment in awaiting better weather conditions.

awaiting better weather conditions. First Flight of New Zeppelin Airship.—The first of the three new Zeppelins, which are to be used for passenger carrying this summer in Germany, made its initial flight at Friedrichahaten on the 30th uitimo. The new airship is somewhat larger than the "Deutschland," which, it will be remembered, was demolished by falling into the Teutoborg challing into the Teutoborg of the Perinament of the medicity of the new dirightip, and it is claimed that a considerable weight will be saved besides the obtaining of a stiffer frame.

stiffer frame.

Untimely End of a Parseval Airship Flight.—At 4:30 A. M. on Friday of leat week the new Parseval airship left Charlottenburg, near Berlin, with 10 passengers who hoped to be landed at Amstardam, Holland, in due course. Near Hanover, after 140 miles of the 200-mile journey had been traversed, the sirahip ran foul of a tree. She finally broke away from this impromptu mooring and came to earth in some bog land nearby. The passengers escaped unhurt, while the airship envelope was deflated and the entarbip envelope envelope entarbip envelope en airship envelope was deflated and the en-tire craft was returned to Berlin by rail. When contrasted with the numerous suc-cessful aeroplane flights across country cesaru aeropiane nights across country with passengers it would seem that a surer way to have transported the 10 passengers would have been to have used five aeroplanes, the cost of which would have been insignificant compared to that of the dirigible.

Testing the Motors of Brucker's Air-ship.—The shop tests of the motors to be installed in Brucker's trans-Atlantic airinstalled in Sprucer's train-attantic air-abip were recently made. The engines have not come up to expectations, one of them being rejected for good. Since it is intended to prevent, at any price, a repetition of the Wellman experiences repetition of the Wellman experiences and to start only if the motors are in it condition, Brucker has decided to postpone his trip until nark November if necessary, several months will be devoted to experimenting. The gas bag seems to have been very satisfactorily and substantially made. November has been selected for the date of the start because the burricane season of the tropics lasts from June until November. The dates in mechanic net unwalcone. The delay is perhaps not unwelcome, since it offers the advantage of testing the airship this summer and of training

Military Aviation in France.—In France the military developments grow apace. Already the army has over fifty machines of the approved patterns, and not many fewer than 100 skilled military air-piluts Moreover the Ministry of War has offered a prize for competition among aeroplane constructors this year. The Army Geo graphical Department has drawn up the construction that year, and and the graphical Department has drawn up the first of a series of maps for the use of flying men. Plated both an altimation is correctly a series of the property of the correct are splashes of green. The ups and downs of the country are shown by means of shading light for a gentle rise, heavy for a high full. Towns and village stand out clearly in red. Windmills, church towers, factory chimners, telegraph wires, even tall isolated trees are indicated. Spois where it is dangerous to land because of uneven ground, hop-poles, vingurads and orthards are marked with red evenesses for the airman to aveid. It is preposed to continue the work and to map out in this way the whole of France.







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Electricity

Electric Flat From Seld Last Year.—Us
is estimated that no iess than 384,000
electric flatfroms were sold in the United
Ettics and Canada last yar, maye the
Electrical World. There are more than
1,0,00,000 homes within constructed to territory, of which fewer than 2,000,000
have electric service; consequently the estimated sales last year appreximates one iron to every eight home. Although the electric iron was on the market almost fifteen years ago, its general use dates back only a few years. Other elec-tric appliances have a similar history of long neglect, followed by rapid introduc-tion.

tion.

Light as a Barrier to Esla—Some time ago the Danish government began, under the discenten of its blookgoist station at Copenhasen, an interesting effort to aid the fahermen of the Bailtic by preventing the migration of cele from that sea into the ocean. The means semjoyed is a "barrier of light," formed by placing fifty electric lamps along a submerged cable between the island of Fano and the coast of Funen. The effectiveness of such a barrier depends upon the fact dark hours. Accordingly, as soon as darkness begins, in the season of migration, the lamps are illuminated, and thus a wall of light is interposed from which the cele recoil. A similar principle is said to have been employed from time immenorial by fishermen on certain parts of the coast of Italy.

Wircless Fleerpaphy on Ships.—The

Wireless Telegraphy on Ships.—The Department of Commerce and Labor is now calling the attention of collectors now calling the attention of collectors of customs in our various ports to the Wireless Ship Act of June 24, 1910, which reads as follows: "Be it enacted by the Sanata and House of Representatives of the United States of America, in Congress assembled, that from and after the first day of July, nineteen hundred and observations attended to the control of the contr severa, it sain to enthineur of any ocean-going steamer of the United States, or of any foreign country, carrying passengers and carrying fifty or more personal control of the Country of the Country of the United States unless such steamer shall be equipped with an efficient apparatus for radio-communication, in good working order, in charge of a person skilled in the use of such apparatus, which apparatus shall be capable of transmitting and receiving messages over a distance of at least one hundred miles, alight or day; provided, that the provisions of this act shall not apply to steamers plying only between ports less than two hundred miles apart."

A New Use for Bakelitz—It will prob-

than two hundred miles spart."

A New Use for Bakelite.—It will probably be a long time before the many uses ably be a long time before the many use delyrde compound its despited forman-charted. The latest application to which this product has been put is the construction of the dielectric and insultors of the so-called electric "influence machine." These parts have intherto been made chiefly of glass or hard rubber, but the former has the disadvantage of being fragile, while the latter soon suffers changes under the electric and chemical influences to which it is exposed, and become until for use. It has chemical influences to which it is ex-posed, and becomes unfit for use. It has been proposed to use calluloid plates, as these are found to be very effective. Un-fortunately they lack rigidity and are dangerous owing to their inflammability. It is therefore a very material gain to find that backlet is not only itself em-imently adapted for this use, but can and that bakelite is not only itself emineuty adapted for this use, but can ing the seams. The lower odge of the
moreover be used to impregnate other
machine of the same dimensions constructed with giass plates. The material
for the disks may either be first subfields are first subfield used to the impregnating process, and
is then cut into disks, or, which is better,
the disks are first cut to shape and then
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Lectaching Tannes in the April Through. "The 9% shift lengt through the Alps in the Canton land, which is being half by engineers, was cut through as list. The French contractors he four and a half years upon the When the tunnel is in working will have cost about fifteen dollars.

Hossac Tannel Bestrification.—The electrification of the Hossac Tunnel, on the New York, New Haven and Eartford Railway, is being pushed forward with energy. The tunnel, 4½ miles long, was built in 1875. Operated at first with coalburning locomotives, these were later re-placed by oil burners, and their place is now to be taken by alternating current motors taking 11,000-volt current from the line.

The Tallest of Tall Buildings.—The Singer tower, with its height of 612 feet, and the Metropolitan tower, just 700 feet in height, are to be eclipsed by the Wool-worth Building, now under construction at Broadway and Barciay Street, this city, whose final will be 700 feet above the street height Burner will be thirty and the street of the street of the street of the tower 55 real building, showe which tower 55 requires will rise for, another 25 stories.

another 35 stories. Superheat is Locomotives.—In a recent issue of the Riversa Indicator, Prof. Wood states that a small amount of superheat in the high pressure cylinder of a locomotive is of little advantage, but when the pressure drop is large between cylinders, a proportionate gain is made by using considerable superheat in the low-pressure cylinder. He finds that superheating to 100 degrees or more for the low-pressure cylinder has theoretically much to recommend it.

retically much to recommend it.

Lift-bridge of Unusual Type.—There has just been completed across the Willamete River at Portland, Orgon, a bridge with a drawspan which is the heaviest apan of the direct-lift type that has been hitherto built. The drawspan is 245 feet long, and weigha about 285 tons. The total lift is 110 feet, and this provides a clearance of 156 feet at mean low water. The lifting is effected by motors with the span to the tower, and seven of concrete counterweights.

concrete counterweights.

The Lawpest Arnsha,—The huge airship which is building for the British
nary at Victor's Sons and Maxim, will
be the largest airship yet constructed,
the overall length being 500 feet. It is
of the rigid type, the framework being
built of an alloy of aluminium known
as duralumin, which has a strength and
hardness equal to mild steel. The ship
will have two gondolas, in the first of
which will be a motor driving two propellers, and in the second a motor driving a single propeller. The engine power
and speed have not been yet announced.

The "Purias" Excernment—Official acc.

The "Puritan" Experiment.—Official ac-counts of the "Puritan" experiment, when 200 pounds of explosive gelatine was de-tonated against the turret armor and against the belt armor, state that the plate of the turret armor was set back plate of the turret armor was set back and considerably dished, and many deep cracks, some of which probably extend through the plate, were opened. Also the seams between this and adjoining plates were Opened up. The turret was not vitally damaged. The charge on the armor belt buckled the plate, swinging armor belt buckled the plate, swinging the seame of the contrast of the cont



nerican, issue of May 13, 1911

First of all, the post First of all, the amount of the control of the cont

A first cousin to the automatic stability times in the man who plucks, as it were, a fiving machine out of his mere insagnation, knowing nothing of the basic principles laid down by Langley, Chanute, Mazin, and the Weight Brothen, M. Moris Knaup will reveal those absurdities in a merrily written and biting article which is fittingly entitled "The Chamber of Horons."

Most secoplanes use engines of 50 horse-power. To be sure they have a greater spread of viving and weigh much more than a condor. But what a difference between 0.05 and 501 Part of this weste of energy is due to the propeller. Assistant: Naval Construct William McEntee, in an article on "Aha Frapalism," will cheer how wasterid of power in the screw propiler, and along what lines imperovement must be made.

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a predominant topic i iblic, and is rapidly be greatest goals of de-progressive engineering ing one of the greatest goals of develop-ment of the progressive engineering and scientific world. In the many books that have already been written on avasiton, this fascinating subject has been handled largely, either in a very "popular" and more or less incomplete manner, or in an atmosphere of mathematical theory that puzzles beginners, and is often of little value to avastors themselves.

to avasters themselves, wide demand practical book on the subject—a treating of the theory celly in its relation to actual aeroplane design mephedy setting forth and discussing webling practices in the construction practice in the construction practice in the construction practice in the construction set and Biplanes is a new and it in procisely this manner, and it able to anyone interested in avas-

Mr. Loming, who has come in intimate contact with many of the most noted arise to a contact with many of the most noted arise and who has made profused mudy of the subject for years, or an expert in this has, In clear and definite spits, and in a remarke the presented the subject of a vision to the processing of the subject of a vision to the presented the subject of a vision to the presented the subject of a vision to the present of the subject of a vision to the present of the subject of a vision to the present of the subject of a vision to the present of the subject of a vision to the present of the subject of a vision to the present of the subject of a vision to the present of the pr

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and Japaness and well-equipped parties
to take part in the genera, campaign of
exploration now under way in the
Antarctic, a similar undertaking, on a
more modest scale, has been launched
in Japan. A party of tworty men, headed by Lisut. Shirase, late of the Japanenglish of the Companies of the Compani

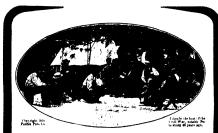
this espection were raised by popular subscription, and amount to on y \$50,000. Birthiplaces of Meteorites.—From time to time there is more or less speculation as to the origin of the meteoric stones and irons that occasionally fall from the sty. The density of these bodies and the great size of some of them are held to constitute arguments in favor of the sty. The density of these bodies and the great size of some of them are held to constitute arguments in favor of the sty. The density of the same of the sty. The density of the same of the same of the precular meteorities that fell some years ago at Brenham, Kansas, it may be inferred from their composition, one authority has suggested, from what part of the heaving body that ejected them they came. The heavy metallic meteorities called siderites may plausifily be supposed to have come from the deeper parts of a star; the light, slony ones called aerolitics, from the superficial layers and the rare "paliability." like the parts of a star; the light, slony ones called aerolitics, from the superficial layers and the rare "paliability." like the mediate in composition, from the transitional zone between the outer crust and the dense interior nucleus.

Measuring with Balloons.—Some time ago there was employed a unique method of measuring the height of certain of the great dome-shawed chambers in the Mammoth Cave. The investigator called to his assistance the toy balloon, and after some preliminary experiments, had believe the state of the us oanoons made of a special pattern, with thinner and more elastic rubber than that usually employed. Then, with thinner that the state of the state of the line of the line

ceiling

Views Illustrating Terrestrial Relief.—
According to the Brottish Geographical
Mapazine the plan proposed at the Ninth
International Geographic Congress to
prepare an atlas of photographic views
Illustrating the various forms of eroston,
has been eniarged The committee
charged with this undertaking, viz. Pro
fessors Emile Chaiz, J. Brunhes, and E
de Martonno, dedded to isy before the
next congress, which assemblee in Rome
this year, plans for an atlas of some 500
to 500 plates overting terrestrial relief in
general Each plate will be accompanied. general Each plate will be accompanied by a sheet of descriptive letter press, containing a brief description of the plate, a topographic map showing the exact point at which the view was taken, plate, a topographic map abovemp the search point at which the view was taken, as the search point at which the view was taken, the search point and others. The plates will be issued in sets, and will be classified either systematically or according to regions. It is hoped to publish first, two sets including about twenty plates, desling with (1) forms directly influenced by tectoric conditions, faults, tolding, etc., and (2) forms affected by glaciation. The members of the committee solicite, and (2) forms affected by glaciation. The members of the committee solicite the other plates are the committee of the committee solicite to other plates. The committee of the committee of

The Man Who Found Himself



A gray-haired citizen of Tampa, Florida, turning over the pages of the November Review of Reviews, saw this picpages on the reoverineer neview of neviews, saw this pic-ture, and in the young man on the ground with the bottle was amazed to discover himself. Like a flash the years vanished, again he was outside Petersburg in '64, the air roared and shrieked with the he was outside Fetersburg in '04, the air roared and shreece with the fire of two armies, and he and these other members of the 9th A. C, U. S. A., whiled away a few weary minutes having "their pictures taken." Afterward he had forgotten it. Today, he has grown old, but the pictures will be forever young.

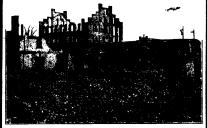
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The Commissipners of Parks and of Docks, New York, propose to Sill in a strip of the Hudson River foreshore. 200 feet wide and 2½ miles long, between 81st and 138th Streefs; build thereon docks, platforms, and railway tracks for steamship freight traffic: roof the structure over; and lay out a park for public use.

COVERING A RIVER'S FRONT WITH DOCKS, TRACKS AND PARKS.—[See page 446.]

The street day to make the street

SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, MAY 6, 1911

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The folitor is always glad to receive for exummation illustrated articles on subsects of timely interest. If the photographs are sharp the nations down, and the facts authorities, the contributions will receive special attention. Accepted articles will be paid for at regular space raties.

The purpose of this journal is to record accurately The purpose of this fournal is to record necessaries, and in simple terms, the world's progress in scientific knucledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Artistic Engineering

T IS deplorable that engineering works, and particularly those of great magnitude, so often, both as a whole and in part, should be wanting martistic beauty. By way of defense, the engineer will tell you that his structures are works of utility; that they are based on certain inexorable laws of physics; that any departure from these laws can be made only at considerable cost; and that the heavy capeuse which is inseparable from his work puts him under obligation to use not a pound of steel nor a cubic yard of cut stone or concrete more than the structural necessities of the problem before him de-

Furthermore, he will tell you that a work which perfectly falfills its purpose, and does so at a minimum cost, is inherently artistic; and that to change the lines and masses as determined by the structural requirements of the work, and enrich it with artisrequirements or ine work, and enterin it with artis-tic embellishment, is at once to violate the strict principles of engineering and rob the completed work of its proper inherent dignity by clothing it with meretracious and unmeaning display.

To a certain extent the engineer is right; to a greater extent he is altogether wrong. Although a well-designed engineering structure does possess a certain dignity, due to its perfect mechanical adaptation to its purpose, it rarely happens that an archi-tect, if called in for consultation, could not suggest certain slight and inexpensive modifications of form, or even the judicious use of architectural decorations, which so far from disguising would rather serve to accentuate the purpose of the structure, and, in their total effect, would therefore add to its dignity

and general esthetic appearance.

If any one doubt this, let him take a look at the architectural features of the two anchorages of the new Manhattan suspension bridge, and the slight architectural iron work ornamentations which have been applied with such good taste at the top of the and where the same are intersected by the

And, by the way, it occurs to us, just here, that the engineer, with much show of reason, might turn upon the architect and remind him that criticism, like charity, should begin at home; for the architeet frequently fails to produce a good effect simply for the reason that he has ignored altogether those very principles of construction which the engi-neer is apt to carry too far. Proof of this is found in many of the lofty office buildings, and particularly those which stand on a square plot of limited area.

A building of this character is nothing more nor less than a tower, and in determining the dominating lines of the structure, the architect should emphasize the vertical lines at the expense of the horizontal. As a matter of fact, the majority of tall buildings to-day show that the architect has done exactly the opposite of this; and the result is con-

fused, inartistic, and often positively irritating.

The medisval builders of Italy made no such Intermediaval builders of Iray Made no such mistake, when they planned those lofty and schuder buildings which are to-day the delight of the artist-and the man with the sketch-pad, camera and note book. Fortunately, there is a growing tendency among American architects to recognize these con-

siderations, which they have applied to some of the later and taller buildings with happy effect.

At the same time, it goes without saying that the architectural or esthetic embellishment of engineerarcintectural or esthetic embellishment of engineer-ing works should be applied with a discriminating eye and a most sparing hand. Such additions can never entich unless they truly adorn, and they can adorn only if they emphasise the uses to which the engineering structure is to be put, or the porticular function and child decading more its rate.

metion or duty devolving upon its various parts.

The late Sir Benjamin Baker, replying to the freent charge of artists and architects that the Forth quent charge of artists and architects that the Forta-Bridge was inherently ugly, replied that only an engineer, or some one familiar with the principles of engineering, could be a true judge of that ques-tion. "The fact that a Cortathian column," said Baker, "is an object of beauty when supporting the entablature of a classic temple, would not justify us in setting it up as a smokestack on an occa

Better no decoration whatever than decoration musapplied; but best of all is that general asthetic treatment, with perhaps a slight but judicious modi-fication of form, which can usually be obtained by an intelligent and sympathetic co-operation betwee the engineer, the architect and the artist. The r cognition of this fact is one of the most happy aug-uries for the constructive work of the future, particularly in the domain of public Federal buildings and the more important municipal works of engi-

Why We Outbid Europe on Battleships

N THE article on the upbuilding of our Ameri-can merchant marine, published in our last issue, Mr. Bowles, the writer, indicated in a brief way A.M. Bowles, the writer, indicated in a brief way the conditions which make it possible for American yards to compete successfully with those of Europe in securing foreign orders for battleahing. This is a vital question which has caused no little bewilderment. If our shipyards can build the complicated battleahip more cheaply than it can be built abroad, which it is taked of bother many those similar presents of the contract why, it is asked, can they not show a similar or even greater advantage in constructings the simpler and less costly merchant ship?

The answer is to be found in Senate Document No. 438, of the 61st Congress, which contains a letter from the president of the Fore River Shipsever from the president of the Fore River Ship-building Company, addressed to Senator Frye, in which the writer states that in merchant vessels the cost of the vessel to the shipbuilder is divided almost equally between labor and materials, where-as on a battleship from two-fifths to one-half of the as on a battleship from two-nitus to one-half of the cost, depending upon the nature of the design and the extent of the equipment furnished, is in the armor and armament, which the shipbuilder merely puts in place, and which is supplied to him, in the case of the United States vessels, by the Government itself, and in the case of private contracts by a subcontractor. In the case of the hull and machinery, which the shipbuilder provides, the pro-portion of labor is smaller and the proportion of materials and auxiliary machinery much greater than in a commercial vessel. The shipbuilder's cost of labor is much greater in the United States than in forest Britain and Germany, being placed variously from 40 to 80 per cent greater here than abroad, and this, of course, affects the cost of a naval ves-sel in the same way that it does the cost of the commercial vessel, but much less in proportion to the total, as explained.

In building battleships abroad, there is considerable competition among the shipbuilders to obtain contracts for hull and machinery, and the prices of hulls and machinery obtained by foreign governhulls and machinery obtained by toreign govern-ments are moderate, but not on such a low basis as they are under the severe competition existing in the United States. The manufacture of armor, guns and gun mountings abroad is confined to a few large concerns and competition between them does not appear to be active. The consequence is that the prices for armor and armament abroad are high.

An examination of the costs of completed battle-ships for the United States and abroad indicates that the United States Government has been obtain ing its vessels always at prices not above the abroad, and in recent years for prices considerably less; the average for the last few years being 15 per cent less for the completed years in the United States than in England.

Under these circumstances, the American firm always held an advantageous position in the count always held an advantageous position in the reseme competition for two Argentine battleships; for at their regular prices and with me of their Curtis tur-bine, which is cheaper and more efficient; than the English type, they had a mergin in their favor can-abiling them to offer something better at the again price; which they did and won out on them dest promising the standard of workmanship set by United States Navy.

ATESTICAL PROPERTY OF THE PROP

Testing Suspension Bridge Chains After One Hundred Years' Service

HATEVER other claims Newbo MATEVER other claims Newbustynes,
Massachusetts, may have upon public interest, the town may surely be proud of
the fact that in the old chain bridge across the
Merrimae it possessed the most interesting historical
structure of its kind in the world. Furthermore, in
view of the fact that for one hundred years it view of the fact that for one hundred years it stood up faithfully under the ever-increasing burden of highway traffic, this bridge, considered from the engineering standpoint, has made a record that is unapproached, as far as we know, among similar structures of the suspended type. The Newburyport span, creeted in 1810, and closed in 1908 after a century of useful service, has remained as the most lasting monument to the genius of Finley, its designer. According to a description of the bridge published in the Newburynort Harald of Descender

lished in the Newburyport Herald of December 18th, 1810, the suspended span measured 240 feet between towers, and the floor was carried upon ten chains, each of which was 316 feet in length from chains, each of winch was 316 feet in length from anchorage to anchorage, the from used in the chains, anchor plates, etc., weighing altogether 22 tons. It is stated by a resident of Newburpport that the chains were forged on the spot, and that the old amithy in which the work was done is still stand-ing. An official irrepection was made of the bridge smithy in which can be some and of the bridge in 1885, and in 1891 it was again officially inspected, this time to ascertain the ability of the bridge to carry safely the electric cars that had for some time been running over it. The only disaster in its one hundred years of service occurred February 281, 1887, when some of the chains gave way under the joint load of a laden wagon drawn by six ozen and was horses. and a heavy accumulation of snow. In two horses, and a heavy accumulation of snow. In rebuilding the bridge, it was decided to add two or three chains in addition to the original number. In 1870, when the bridge was eighty years old, a service of heavy electric cars was run regularly sessice of heavy electric cars was run regularly across it; but because of the extreme vibration of that half of the roadway over which the tracks were laid, the Roebling Company were called in, and in 1894 the structure was reinforced by 2-inch twisted steel cables.

After the condemnation of the bridge, there a most interesting investigation by Mr. A. P. Mills, Assistant Professor of Materials, Cornell University, who made a series of tests of the original Noriron chain links, to determine their physical condition after a century of continuous service. These tests showed that the average ultimate stress per square inch of the links was 37,550 pounds and the average elastic strength of 23,880 pounds per square inch. It is an interesting fact that the three links showing the highest tensile strength broke with an erystalline fracture, and of the five showing the lowest strength, three showed a fibrous break. Furthermore, the degree of corrosion was found to be greatest on the links showing a very fibrous structure, and it was much less in the links showing a decidedly crystalline fracture.

The chemical analysis of the iron brought out some surprising facts, as will be seen from the fol-lowing percentages: Total carbon, 0.100; silicon, 0.015; sulphur, 0.007; manganese, 0.006; phosphorus, 0.055; copper, 0.830; nickel, 0.040; tellurium, trace; slag, 0.220; Iron (by difference) 99.207. This analysis shows the silicon, phosphorus, and especially the manganese and sulphur to be very low; which is not apprecially the transparese and sulphur to be very low; pecially the manganese and sulphur to be very low; which is not surprising, in view of the purity of the ores of Sweden and Norway. Very surprising, however, was the discovery that the slag amounted to only 0.29 per cent, since this iron must have been made either in a Catalan forge or some officer primitation was the chancel hazards. tive type of charcoal hearth.

The most significant discovery was the existen

of 0.35 per cent of copper in the iron, and Mr. Mills is of the opinion that the crystalline fractures were primarily due to the presence of the copper. He also believe that the freedom from corrosion was due and cultives that he receion from corrosion was due largely to the presence of the copper and not mercely to the purity of the iron. This view is supported by the fact that the most hadly corroded links invariably reveal a firmous knowless, while these which showed a coarse, crystalline fracture were most re-

mbreed a coarec, crystalline fracture were, most re-markably free from corrosion.

By no neans the least interesting fact concerning this venerable structure is the elementation that, at the close of its one headered years of service, it should have picked in the laboratory of the picture in the control of the control of the control of the strength and properties of categorial, its

Charles Proteus Steinmetz: An Appreciation

A Great Electrical Engineer

By Joseph B. Baker

The ATEINMENTZ, Chief Consulting Engineer of our largest electrical companies, is an investor of extraordinary talent, and at the same time a ly wideswake man of affairs in the big field that he has toade for himself, and he is one of the dense the feremost living protagonist of modern in s as a branch of manufacturing, his work, and

vesting as a branch of manufacturing, his work, and the self-efficing way in which he does it, are an in-spiration to young men who are forwing their ideals. (Charies Protus Steinmest was born April 9, 1865, at Siyalan, Germany. He was educated at the Bre-sell "granastium and university studying math-matics, 'astronomy, bysics, chemistry, and other heraches, 'including national economy. Having par-ticipated in the social democratic agitation, he incurred the displeasure of the government and escaped to Switzerland in 1888, and there studied mechanical he emigrated to America, and found a position with the Michemosyar-Field Manufacturing Company, first as dysitatoss, then as electrical engineer and designer, and finally on research work

in charge of the Eickemeyer laboratory. With the absorption of the Eickemeyer inuts by the General Electric Cours ets was attached to Mr. H. Parshall's calculating department in Lynn, Mass. With the transfer of the company's headquarters to Schenectady, N. Y., in the apring of 1884, Mr. Steinmetz organized and took charge of the calculation and design my's apparatus, and of the re rch and development work. Since 1902 he has been Professor of Electrical Engineering at Union University, at the same taining his connection with the General Electric Company as Consulting Engineer, and has in the last year again en-tered in closer relation with this company

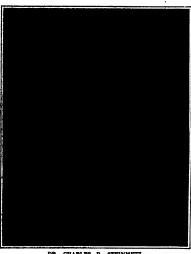
teres in cross relation with the comparison of a Consetting Engineering Department.

Even the briefast contact with Dr. Steinmets reveals a singular individuality, and that of a very high order. The impressions that of a very high order. The impressions one develops are: A man of fine and ready mind, and one crammed full of the pa-sion for work; a scientist, persistent, even reientless in the pursuit of any idea which engages his attention at all; and an indi viduality which combines authority in utterance with a remarkable childlike perlar winter meetings of the American In-stitute of Electrical Engineers, Dr. Steinmets comes down to New York as scalously as any young electrical student, and he with him enough ideas to equip a full convention of a national academy of acience. Perhaps the occasion is the pre-sentation of a paper on high-voltage surges in electric

sentation or a paper on nign-voltage surges in securic power transmission lines. While the members are assembling, he may be seen hobnobbing with dis-tinguished inventors and obscurs members, with the same whelly unceasedus feeling on soud-ellowably and enjoyment of the evening expressed to the one o other. Once the serious business of the as to the other. Under the serious business of the evening has commenced, hewever, he listens; and when it comes time for the discussion of the paper, then arrives the real opportunity to see the man in when it comes time for the discussion of the paper, then survives the real opportunity to see the man in action. It has become the generally accepted customs ty sate Eg. Stainment to close the discussion at meetings of scientific hedder. At the Institute, when it is called upon, it is with a feeting of affectionate variantisms that one cess him rise to his feet and again one of this insurviveire disquisitions, making history with every word that he titlers, and, at the very large the staining the electric throught that had been in solving as the wines of the meeting, or, on frequent consideral, helding and institutioning the general threads and "awhite down the large with the irrestriction of the Children's Children'

A CONTRACTOR OF THE CONTRACTOR

electrical manufacturing company which has been so fortunate as to enjoy his services for many years, he is very much of a free lance. His time is divided between his office at the factory and his home in the park-like new section of this old Dutch town. He comes to his office by appointment, for the most part, part in some conference on fundamental manufacturing policy, electrical or mechanical theory, or other important matters; but it is the writer's impression that he prefers the working atmosphere of his own home, where he has a wellequipped laboratory. Dr. Steinmets's house and his laboratory and his wonderful greenhouses constitute one of the "show places" of Schenectady, and an account of them might make an article by itself. wherever he may be, he is the most approachable man in Schenectedy County, and at the same time the man most forcefully insistent—relentless is the word again—in sticking to the main point of the interview. The writer well recalls an occasion when. as associate editor of the General Electric Review



DR. CHARLES P. STEINMETZ

he had received for publication from Dr. Steinmets some notes on the theory of the steam turbine. An interview was necessary in order to expand the subject into an article, and this interview, which took place on the veranda of Dr. Steinmets's home, was packed about as full of interest as one might imagine an interview would be with the German Kaiser on subjects, or with Colonel Roosevelt on hunt-

Dr. Steinmetz's published works exemplify his faculty of helpfulness. They not only instruct the mathematician who too often regards engineering problems merely as opportunities for the exercihis science for its own sake, but they delight the practising engineer, who ordinarily prefers to make a shrewd, intuitive guess at the whole result, in dealing with his problems, rather than "bother with mathematics." In Steinmets's numerous electrical papers, many hitherto obsoure departments of elec trical engineering are reduced to an exact science by original and effective methods for the precise calcu-iation and predetermination of apparatus and phelation and predetermination of apparatus and pha-nomens. Most of these papers have been published in the Transactions of the American Institute of Electrical Emphasers. Thus in his most recent work, "Emphasering: "Maximum tion," he dwells on the im-portance of stagisting the mathematical tool to the work in hand, and stree, numerous accellent sugges-tions which help the reader to apply analytical methods to sagineering problems. His lext is Huminated by common sense, clucidated by well-

ore than the public will ever come to realize, and it resides largely in bringing out the best work of others. This is true especially of his inventive work, which more often takes the form of pregnant initial hints for others to follow up, and of illuminating suggestions in conference on inventions initiated by others, than of "inventions" in the ordinary sense, credited to him from start to finish In this respect he is a worthy compeer of Faraday, who was content to discover and announce the fundamental laws of magneto electric induction, and leave to others the building of dynamo-electric machines and elec-

One of his numerous occupations is that of Profeasor of Electrical Engineering in Union College, and it would be difficult to decide which is the greater personal treat, to sit in the classroom and listen to the scientist's illuminating explanations, or listen to the scientists infulnimating capitalists, to foregather with the college boys at some fraternity meeting and see him circulating through the crowd, encouraging one, perhaps tactfully rebuking another on some point of electric lore, or again sit-

on some point of electric lore, or again sit-ting in their midst and beaming with happiness at the good time everyone is having. munity that he is.

at is the secret of his unexampled abilities, and of his equally unexampled practical application of these abilities in an intensely modern world of concrete formance where, to live and move and have any being worth the name, the scientist must keep his feet on the earth, even if his head is in the clouds? The answer simple as the nature of the man himself. From the time he was "discovered" by far-seeing officials of the old Thomson-Houston Electric Company, after a strenuous ap prenticeship in the Eickemeyer-Field labo atory, Steinmetz has developed this truththat there are plenty and plenty of right ideas in the infinite realm of mind, and that he best brings out these ideas who do try to scrape some of them off and hoard them away, selfishly, but simply to perceive them, bring them out through his own or others' work, and pass them on to the world with his individual benediction.

Cholera and Immigration

During the year 1910, cholera attacked 214,000 persons in Russia, with a mortality of 46 per cent, and claimed 5,000 vic-tims in Turkey There was an epidemic of cholera in Naples, and four cases were re-ported from Marseilles In general the disease continued to advance westward, and there is no hope that it will be extinguished in all of the places where it existed

beginning of the present winter In a communicatio to the Paris Academy of Medicine, Drs. Chauterness In a communication and Borel cits several facts which prove that cholera can be carried in a latent form and demonstrate the important part played by immigration in the propagation of the disease. Germs of cholers have been found in persons 30 days after their departure from an in-

Boracic Acid

CORMERLY all the boracic, or boric, acid of commerce was obtained from borax by heating it with calcined ferrous sulphate in closed vessels, whereby sodoforic acid was formed, and boracle acid was car-ried on with the watery vapors, which escaped

This was a long and tedious process, and not much progress was made until it was discovered that boracic acid could be obtained from the boiling aprings and jets of vapor in Tuscany Long after the discovery of boracic acid in these springs, the bri! struck the physicist as well as the chemist to employ the heat of the natural steam jets. This method had the effect of converting an unprofitable branch of industry into one of the most su

The lagoons are situated near the top of one of the highest hills. As the volcanic vapors pass through the waters of the lagoons the boracic acid is arrested by the water, which becomes impregnated with it. California it occurs as the mineral sassolite, and crustation on the crater of a mountain in the Liparl group, north of Sicily.

Heat from Dust

Utilization of Low Grade and Waste Fuels

By Charles L. Wright

Fuel Engineer in Charge of the Fuel Briquetting Investigations of the United States Bureau of Mines

THE natural resources of our country have been considered so inexhaustible that it is only very re cently that the attention of the public has been directed to the enormous amount of material wasted in our various industries, and it is to be hoped that the socalled conservation movement may continue until as a nation, reach the industrial efficiency that has been attained by the older countries-Great Britain, Germany, France, and others. Furthermore, it is to be hoped that we may not wait as these countries have until the most valuable resources are gone for-ever, before putting this conservation process into

According to the United States Geological Survey's report, 459,209,073 short tons of coal were produced in the United States in the year 1909, of which 83,00 600 short tons were anthracite coal from Pennsylvania

in the eastern section of the United States, where most of the coal is mined and used, the price of the better grades of coal is stendily increasing. It is now estimated that the maximum tonnage of anthracite possible to produce annually has nearly been reached If this is true the price of this popular domestic fuel will in a few years place it out of reach of all but the wealthy for a domestic fuel. Then people must look for some other kinds of fuel which will be suitable for household use
On the other hand, the demand for industrial fuel is

increasing more rapidly than the development of coal

mining, and therefore manufacturers are already on the lookout for a more economical fuel in order to reduce the cost of production, or at least to keep it from being increased Our industrial prestige is due in no small measure to our having had great natural fuel resources; and as competition becomes keener with other nations and the price of our fuels is at the same time advancing, we must make use of the cheaper fuels

and fuel wastes in order to hold our present position.

The purpose of this article is to discuss in a general way the various materials suitable for fuel which are now wasted or considered of small value, and therefore disposed of at a low price; and to discuss the ways that such wastes may be utilized to better ad-

The following fuel wastes and low grade fuels are considered in this article: Bituminous slack, anthracite culm, coke breeze, sawdust and wood waste, lignite coal and peat.

Bituminous Black. Most companies mining bituminous coal screen all or part of their product before shipping, to remove the dust and finer pieces of coal which is called "slack." The size of the opening in the screen used varies with different operations, but the size of opening most commonly used is % of an inch, so generally speaking slack is that portion of the mined coal which passes through the screen with 1% inch openings.

As high as 50 per cent of the coal mined is in the

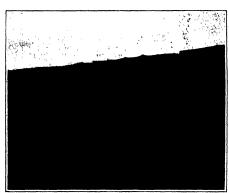
form of slack. Formerly there was no market for this slack, and it was dumped in plies near the misse and accumulated from year to year. These piles of slack were sometimes set on fire to get rid of them. and would smolder away for years.

At the present time there is in certain parts of this country, for example the eastern and middle States, a market for this slack coal for use in special furnaces, as an industrial fuel. There is not, however, a market large enough for all the slack produced, and in many places, if it is sold at all, it is sold at a price which is less than the cost of pre profit of the business being made from the sale of the larger sizes. Around Pittaburg slack may be had in carload lots for 85 cents to \$1 a ton delivered at the plant. In other States it brings 15 to 50 cents per ton, loaded on cars at the mine. How this waste by means of iriquetting and the gas-producer can be son-verted into desirable household fuel and power will

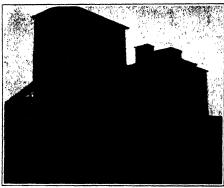
be described further on in this article.

Anthracite Culm. Anthracite culm is similar to bituminous slack in that it composes the smaller sizes of anthracite coal. As with bituminous coal these finer sizes were formerly a waste material, and in the anthracite fields of Pennsylvania to-day there are great hills of this culm which have accumulated for many years. Anthracite culm however possesses the advantage over bituminous slack that it produces practically

(Continued on some 456.)



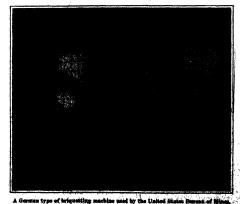
A pile of clam-shaped fuel briquets.



A typical fuel-briquetting plant.



Briquetting machine of English make. Note the briquets in the wheel-barrow.



The state of the s



speaking of engineering works of magnitude, we may surely make use of it in connection with the recent opening of the new graving dock at Belfast, Ireland, by the admission into the structure of the White Star liner "Olympic," when the greatest ship in the world was safely beribed in the world's greatest masonry dry dock. The dock was constructed through the foresight and enterprise of the local authorities of the Belfast harbor.

The main contract for the work was entered into late in the year 1903, and active work was com-menced early in 1904. During the intervening seven years a large force of men has been continually at work, and the magnitude of the operations may be judged from the fact that upward of 300,000 cubic yards of sand and clay had to be removed, and that in the excavation thus made there has been formed a er-tight masonry basin nearly 900 feet long and 100 feet wide, into the construction of which entered 76,000 cubic yards of concrete, 24,000 cubic yards of brickwork, and 36,000 cubic yards of cut granite. The contract called for the completion of the work in three years and four months from the date on which construction began; but two serious subsidences in the large Alexandra graving dock alongside delayed the k, so that about seven years altogether have been

one of the largest in the world, is 80 feet wide at the on the floor, with a floor length of 800 feet. The new dock is 98 feet wide at the entrance, 100 feet wide on the floor, and 850 feet long on the floor when the caisson gate is placed in its normal position at the entrance By floating the gate out and placing it against the outer face of the dock entrance,

the total length on the floor is 887% feet In view of the constantly increasing length of ocean liners, the construction of the dock has been carried out in such a way as to permit of the permanent lengthening of the structure to the extent of 200 feet Whenever this is done, a normal length of clearance will be available of 1,050 feet, sufficient to comfort-ably accommodate the much-talked-of 1,000-foot ship of

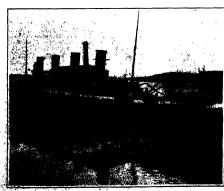
the future

The following further particulars will be of interest: The width at the coping level is 128 feet, and at the lowest altar course 104 feet 6 inches; the depth of floor at center below level of high water of ordinary apring tides is 37 feet 3 inches; the top of keel blocks below level of high water of ordinary spring tides is 32 feet 9 inches; height of top of blocks above floor, 4 feet 6 inches, level of entrance sill above floor at center of dock, 2 feet, bottom of floor at sides of dock below coping level, 43 feet 6 inches, thickness of

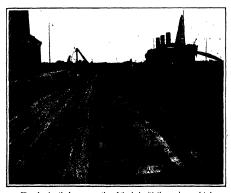
floor at center, 17 feet 6 inches, thickness of side walls

at bottom of battened face, 18 feet 9 inches
The emptying of a dock of this huge size calls for
a powerful pumping plant, and three engines, each of
1,000 horse-power, working together are able to pump the dock dry in one hour and forty minutes, even when there is no vessel in the dock. To do this necessitates drawing out about twenty-three million gallons of water. The auxiliary plant is built on the same generous scale. Thus, the hydraulic capstan equipment consists of three each of 30 tons capacity, and two of 11 tons: big units, it is true, but none too large for handling ships of the size of the "Olympic" and "Titanic". The next largest capsians found at the Admiralty yards, each of which is only 16 tons capacity

The old system of hinged swinging entrance gates is no longer used on modern dry docks of large capacity, their place being taken by floating steel caissons. The gate for the new dock is a massive rectangular structure, which, when the dock is open, is contained in a recess on the west side of the entrance. It travels upon two lines of heavy rollers, set on the floor of the dock, and is moved across the entrance by special hydraulic appliances, the opening or closing being done in about five minutes' time a vessel as long as the "Olympic is to be docked, the



he calmon gate was finited arre-two 1.000-horse-power engines.



View showing the long perspective of the duck with the nearly completed "Girmsic" alongside.

on is floated out and placed against the granite faces of the outer entrance sill, thereby adding 371/2 feet to the normal length of the dock. On the floo of the dock, along its central longitudinal line, are 382 massive cast-iron keel blocks, with timber cap ping pieces. These blocks receive the entire weight of 38,000 tons of a vessel like the "Olympic," when they carry her huge bulk without the least injurious strain upon the ship's structure. It may be men-tioned that the overall length of the "Olympic" is 8821/2 feet, its breadth 97 feet 4 inches, and its gross tonners 45.000

Covering a River's Front with Docks, Tracks and Parks

A PRESSING need which is forcing itself upon public attention with an ever-increasing demand is that for adequate and properly disposed dock facilities at the port of New York.

Also, the city is suffering from the results of one those many hastily-granted franchises of the earlier years of its history, which are now presen ing obstacles to the city's growth, to say nothing of other disadvantages which were little thought of at the time the concessions were granted. We refer to the fact that the New York Central Railroad Company's freight lines extend along the westerly shore line of Manhattan, from the north of Manhattan to within a mile or so of the Battery.

The lack of proper dock accommodations is very injurious to the port of New York, and the presence of the New York Central tracks, running, as they do, at street level, is at once an offense to eye and ear and nostrils, and, as the annual death list shows, a peril to human life

Dock Commissioner Tomkins and Park Comm sioner Stover have united in presenting to the city authorities a plan by which the railroad tracks, where they front upon the beautiful Riverside Drive and Park, shall be hidden from view and an additional two miles of dock frontage provided, with suitable landings for cars and the proper track fa cilities for the distribution of the freight; while, in addition to this, a strip of park land 200 feet wide and 21/2 miles in length, will be placed at the disposal

We present on the front page of this issue a bird's eye view showing the salient features of this pro posed improvement. At an average distance of 200 out from the present shore line, a riprap wall will be built, and the intervening space filled in with suitable material. Adjacent to the present tracks of the New York Central Railroad space will be reserved for two additional tracks, to be built by the com when the increased traffic of the future calls for them Then, in their turn, will be constructed three municipal freight tracks, a broad loading and unloading platform, a driveway for vehicles, a wide platform for receiving river and ocean freight, and, finally, along the dock front will be a pair of tracks for the use of freight unloaded from or to be delivered to

steamships.

The whole of this area, up to the edge of the steamship loading and unloading platform, will be covered by a massive steel and concrete roof, and upon this will be laid a covering of earth of sufficient depth to meet the requirements of a park, and support a growth of turf, shrubbery and trees. The park, as thus formed, will be laid out with walks and windings paths to conform to the pathways existing on the s of Riverside Park Large openings will be pro stopes of intersuals for lighting and ventilating the covered-in tracks and roadways, and in that portion of the new park which is opposite Columbia College a stadium will be laid out for the use of the university.

the expectation of the commissioners that practically all of the rock required for the ripren and ne-sixth of the earth necessary for filling purposes will be obtained from the excavations of the proposed Lexington Avenue-Broadway subway. The remaining material, about one million cubic yards, can be obtained from selected materials, such as clean ashes, of the Street Cleaning Department, and from the various excavations for buildings in the district bordering on the proposed work.

There is a precedent for this improvement to be found in such cities as Antwerp and Vienna, where the water front has been so judiciously improved that its commercial value has been increased, and its artistic development greatly promoted

The plan of operation in receiving and distributing freight will be as follows: Car floats carrying freight received at Jersey City on the roads which terminate there, will be landed at the diagonal which perminant there, will be landed at the diagonal piers at each end of the new pile wharf. They will be switched to the water front tracks, if they are destined for water transportation by ship or river element, or to the in-

shore municipal tracks if they are intended for trans for by the municipal railroad to the city, the revers ions taking place for outbound freight. operations taking place for outbound freight. The regist from shipping will be unloaded to the plac-from adjoining the water front tracks, there examples, by the outborn suthorities, and then other leaded if the water front tracks for railroad handling or tellus away by trucks on the rendway. In conclusion, it should be noted that electric trac-

tion becomes a positive necessity where so m tracks, carrying a heavy freight traffic, are to roofed over. It can thus be seen that the leng-talks of nuisance of noise and smoke, which has troubled the residents of Riverside Drive, will be by the groposed method effectively abated.

Cyrene and Dr. Herbert de Cou

By Prof. Aifred Emerson, Chicago Art Institute

S IMON of Cyrene, who carried the Saviour's cross, preserves a pale memory in Christendom of his native city, once the capital of Greek Africa. A number of Dorian islanders planted a European colony on the great Libran headland to the south of Greece proper 640 years before Christ. Thus, to the Arab conquest of North Africa, A. D. 640, Gyrene and the Cyrenaisa had a longer history than ancient Ros itself. There, too, a dynasty of kings gave way to republican government. Sometimes the Libyans pressed the Greek colony hard. But Greek Africa pressed the Orient blod in and a fat Greek Arrica prospered. Cyrene had its own school of philosophy and a famous school of medicine. The poet Calli-machus, the learned Eratosthenes, and Synesius, one of the most elegant divines of the early Christian church, were Cyrenians. The city had over 100,000 inhabitants. The Ptolemies gave kings to it again. They favored the ports of Apollonia, Ptolemais and Berenice (now Tolmeltah and Bengazi) at the inland city's expense. Trajan's harsh repression of a Jewish rebellion in the Cyrenaica was Cyrene's "finish." It has no Moslem history like Bengazi and Tripoli. Nomad Bedouins and Cretan squatters now dispute possession of the ruins at Grennah

An Italian doctor, Della Cella, accor Pasha of Tripoli to the Cyrenaica overland about 1800. His relation is about the first modern account of the country. Lieutenants Smith and Porcher of the Britnaval service explored its principal antique ruins in 1861, and enriched London with some fine marble sculptures of late period. But these were mere sur-face gleanings. Foreign consuls and vice-consuls have exported some fine painted vases from Bengasi, and so have the Turks.

What a country for a thorough archeological explo want a country for a morouga aronsologuest exportant tion! The writer visited Tripoll and the Cyrenafca with Mr. Joseph Thacher Clarke in 1886. A native land-owner told us that there are 29,000 unopened tombs near Grennah. But the Turkish Governor at al favored our project of reconnoitering them so little that a couple of notorious malefactors were any foreigners offering to examine the ancient ruins even with even let slone with a machine. Small encouragement for two unpolitical travelers who had braved the discomforts of a Turkish troopship to reach the region from Tripoli, and would reach Candia only by an eleven-day voyage under sail! In short, all we saw nicely was the cave of Lethe, at a short distance from Berenice, where Herakles outwitted the dragon of the Hesperides. But we did ascertain that the current stories of hostile Arabs were pure rubbish. A Turkish garrison of 5,600 men squeiched any native disaffection or foreign meddling with equal case, always excepting an irrepre sible British consul's unwelcome interference with the slave trade. It is true that they offered me a black girl with a coral button in one nostril. But I have at I have

gri with a corst button in one nosiril. But I have no doubt that my friend the consul would have com-pelled me to release her. We know that the kings of Cyrene were generous pairons of the best Greek artists. Thebis poets, Cretan statusties, Sparkan and Athenian potters and vasc-painters served them gladly. A famous "Cyre-nian" wine cup in Paris shows a sixth century king of Cyrene superintending the weighing and storage of the sliphium crop in person. The picture has The picture bas been called a political caricature on account of its grotesqueness. Théophile Homole found the brons statue of another King of Greek Africa at D status of another King of Greek Africa at Delph'in 1986. It commemorated a royal success at the Pylings charlot races of 462 B. C. We know nothing of Gyre-nian art proper as yet, except the Gyrenian softensis. The painting and the soulipture named previously were by peninsular Greek artists. The Gyrenian missi-masters embellished gold and stree pieces with the emblems of Gyrene's religion and commerce. I saw a splendid head of Alexander-Ammon and a graceful stalk of sliphium on the two faces of a Ographia tetradrachm, now serving as a hatpit head, the other

The vell which the Ottoman government t

to draw around the Crescation is Hitting in Allian T. Agresses and McGriff Sections the former's push "Therefore is recommended and application of Company and the Section of Mortania parallel and Corpora within a the Mortania parallel and Corpora within a the have wen him the smooth-overed Amesia

have vice thin the much-covated fluxes to estimate the consensation there, will move recently. He took the two forecasts american compositency of fluxed pictures and terra, cottas beet to North Adrian with his isst. Herbort Fletcher do for and Hegelin. The expedition was working along the the- of an ancient road well listed with loads and, while constitutions, when its triends had the tragic naves much of Dr. do Cov's assumantation by Arab visitions on March 11th. We hope Secretary Kipty will have be case of the murdered American explorer examined with constigu energy. The British computed of Candida exposed the devices ways of Turkish tripunds when Meslems have murdered Carstellans. The responsibility of the Turkish authorities for the simple or of an accordant foreign acceptant must be justice. ter of an accredited foreign excevator must be silted. The American scholars appear to have omitted no cas-The American echolosis appear to have omitised no embary pre-caution. It is known that they had a Tuerkish military secont, originally of 66 and afterward for 16 mes. All three of them, moreover, piecessed a practical experience of research work in the Levant, having won their puru under Charsies Waldstin at the time he excessed the Argivel Herium for the Archeological Institute of America, Nobedy mobile Greek better than Dr. de Gou when he chose-te. And Greek in the native versacular of a considerable element in the sangks of Bengant, where Solitan Abdul Hamild colonised many Mohammeden Cretans of the state of Contract of the Con after yielding to Crete a few years ago. I have seen De Cou hold an Athenian polloman spellbound with his whimsical eloquence. He was the quiete with his whimsical oloquence. He was the quitestar of mea, too, a teacher who kveyd his volce iso lew to be heard in his own college clearroom. This had comething to do with his serving the American Schools of Classical Studies at Athens and Rome for several years, as secretary and librarian. Chicago, where he leaves a mother and a brother, afforded no scope for his particular talents. During the last year or two he has particular talents. During the hast year or two he translate with Mr. Inches Leave to Mr. The heart of the last the contract of the co iled with Mr. James Loeb of New York, whom he assisted with his antique collections. His knowledge assisted with his antique collections. His knowledge of Greek philology and archaeology was most exact. Wheal aeding as examiner on a competitive Athenian followship sward fifteen years gao. I was stirll greed by the uncanny fullness and accuracy of one set of answer papers in sight Latin and Greek, Greek syntax and history, Mediteranean geography, collo-quial Greek, on how to date ancient inscriptions, and what not "New was Morbard of Cont. March 2018. That was Herbert de Cou. He carried the same uncanny accuracy into his active scholarship. His illustrated publication of the bronges discovered near Argos by the American excavators of the Hersum is an example of it. He conducted everyday inquiries in the same spirit. De Cou once prepared a small catalogue raisonné of Athenian wet-nurses for the convenience of an American baby. How a for the convenience of an American baby. How baby's backelor came by such information pussied the baby's mother. I learned that the guards at the National Museum, where he had an office, had their wives and sitars report to him. The imperturbable here of George Horion's novel. "A Fair Brigand," is a good-humored cariciature of the industrients secretary. Horton knew him perfectly fearless in danger. story makes the American scholar marry the mountain maid who rescued him, and forget his bride on his wedding day, while he feverishly annotates the advance proofs of a rival antiquarian's inventory of the Acropolis bronzes. In reality, De Cou never forgot anyone or anything, unless it was himself. He might show a serene contempt for the omnisolence of a fresh arrival in Helias. But if that rival had come down with typhoid at Mesolonghi, after going come down will typhoid at Masolonghi, array going three at a bad season against the scoretary's advice, the scoretary would have gone after him and nursed him through. Foung women have made great fun to me of the care De Cou took of them when touring the Great highlands with parties of students. Now the MedMerryman has taken him.

Waves in Solid Metal

Weres in Solid Metal

All illustrating the advance in metallurgy and enAgineering, it has been depressivated that seelid
metals many reveal by their attentions the vibrations
to which they have been subjected.

The applicating this phenomenon, experiments have
been silvering proving that a floatifully wave giruleure
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Correnvondence

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A Night Rainbow

To the Billior of the SCHNYIPIC AMERICAN:

An insujual justicumance of nature was witnessed in middlanguist. Mad, the night of April 4th. The day high plans cloudy and was characterized by frequent children, and the control of the city when night extised. About 5 o'clock brought a slight break middle extised. About 5 o'clock brought a slight break price of the was a shown of about 11 and 12 o'clock. At about 11:10 there was a shown of short direction. During part of the time that the rain continued the meen was visible in the west—up 25 or 45 carrishs.

The small light of the moon was hardly noticeable to one looking toward the east, but in the southeast a perfect rainflow developed. It perhaps would be well to quality the statement that the bow was perfect, because it lacked part of the daylight rainbow—the solors.

The bow extended almost from due south to due east, was perfect in shape, and for a few seconds was quite brilliant. The appearance of the light was much the same as the shaft of light from a powerful searchlight, but was curved as is customary with the ordinary rainbow.

This peculier demonstration followed closely upon another freak of nature. During a binding snow-storm Sunday, April 2nd, the entire central portion of the State was treated to severe electrical disturbance. Lightning flashed frequently, the flashes being accompanied by heavy thunder. The bright lightning reflected on the falling and fallen snow was greatered.

It may be that there is a connection between the electrical storm of Sunday, April 2nd, and the night rainbow of April 4th. If the bow had been in the north or northeast, it might be attributed to auroral conditions.

JAMES HEROR, JR.

Indianapolis, Ind.

[While there is nothing anomalous or mysterious about lunar rainbows, they are uncommon enough to be interesting.

The conditions necessary to produce a rainbow are (1) a brilliant source of light, of small angular dismeter, behind the observer, and (3) a horisontal curtain of water drops in front of him. It matters not whether the huninous source be the sun, the moon, as in laboratory experiments, an artificial light. Even a reflection of the sun on the surface of a body of water may give rise to a rainbow, its position in the sky differing from that of the ordinary bow produced directly by the sun, whence we have the interesting homeomean of "interesting" hard "inverted" rainbows. (These and other more or less unusual forms of the rainbow are to be the subject of an illustrated article in a forthcoming number of the Scientific Amendam, and

Returning to Mr. Hedge's observation, we find that he has correctly described the position of the rainbow, but he has overestimated the altitude of the moon. The bow was seen in the southeast—probably farther toward the south than a solar rainbow is ever seen—because on April 4th the moon was aimost in its extense northerly position with respect to the celestial equator. The center of a rainbow is always opposite the luminous source (in this case the moon); i e, it lies in the straight line passing through the luminous source and the eye of the observer.

Now as the radius of the bow is about 42 degrees, it is evident that if the moon had been "up 35 or 45 degrees," the top of the bow would have extended hardly, if at all, above the horizon—unless the observer was standing upon a high hill or a mountain. Reference to astronomical tables shows that the moon was, in fact, some 14 degrees above the horizon at 11:30 P. M., local time, at Indianapolis (and of course till lower at 11:30 P. M. Central Standard Time).

Lunar rainbows are usually described as white or vallowish. There is, in fact, the same disparsion of color in the lunar as in the solar bow, but the former is immensely fainter than the latter, and hence the colors are rarely distinguishable. The apparent brightness of a lunar bow is the effect of cootrast to the prevailing darkness of the sky; hence, like the stars, it can be seen only in the absence of daylight its small absolute brightness, compared with that of the solar bow, may be judged from the ract that the moon, even when full, is only about one-six-hundred-thousandth as brights at the solar bow, she held as the

thousandth as bright as the sun.
On the night of April 4th the moon was about six days old. Its illuminating power was, therefore, relatively small, and this fact gives a unique interest to Mr. Hedge's observation. Lunar rainbows are rarely seen except about the time of full moon

There could have been no conceivable connection between the rainbow of the 4th and the electrical storm of the 2nd, beyond the fact that both were episodes of a protracted period of cloudy and stormy weather, which, as is shown by the daily weather maps, prevailed over the Middle States early in Aprill—Express.

The Law of the Air

To the Editor of the Schentific America.

A recent correspondent of the Schentific America.

Calle attention to the fact that Connecticut and Callfornia have been considering jurisdictional laws to

control traffic by aircraft, and pleads for concerted

action to determine a uniform code. Nations are as

a general thing slow moving bodies, but in this in
stance a promising start has been made, although the

united States is not taking its proper share in the

work. The Comité Juridique International de l'Avia
tion, with which is associated a technical commis
sion, was organized in Paris in the last days of 1909,

and beginning with January, 1910, has been pub
lishing La Revue juridique international; de la Lo
comotion advance under the direction of an interna
tional committee. The American members of the

committee are Arthur K kuhn of New York, Gov.

Simoon E Baldwin of Connecticut, and James Brown

Sout of the Department of State.

From the outset the committee planned to establish a code of the sir, and it began work with a prospectua, carefully drawn up, which after exhaustive scrutiny by capable jurists was approved. A beginning has been made in working out the legal problems, and several articles of the code have been decided upon. The method of study is for each national committee to consider a specified subject, and reach a decision as to the working of the articles dealing with the matter. These reports are then studied in joint sension and a final recension arrived at. The result is very workmanlike, and means to meet international needs.

Nationally the American Bar Association's Committee on Jurisprudence and Law Reform has before it a resolution of Gov Baldwin's on federal control of aircraft, and a draft act on the subject was published by him in the Michigan Law Review, November, 1910 It provides for uniform registration

ber, 1910 It provides for uniform registration

Cambridge, Mass Drnys P Meyres

Ups and Downs of Acetylene By Marius C. Krarus

ONLY the rapid development of the autogenous welding process, by which metal may be joined to metal without the use of any intervening solder or spelter and usually also without employment of flux, as saved the acetylene gas industry and the pro ducers of calcium carbide from the courts of bank-ruptcy. For several years the steadily dropping prices for carbide threatened ruin to all who had gone into this production in Europe. A mutual agreement, by which the output was reduced to less than one-half of the capacity of the plants, stemmed the downward tendency somewhat and offered an example to the orld of artificial throttling of competition, on an international scale, which could not well have been spared, since governmental interference with the selfimposed restrictions would inevitably have resulted in a considerable destruction of values. It seems characteristic of the advancement which has taken place in the understanding of co-operative methods that the carbide producers of Norway, Switzerland, Germany, England, France and Italy were able to reach a basis for agreement, although those whose production was conomical had to submit to much the hardest terms in the way of restricted output, while the production of the Norwegian works, for example, being duction of the Norwegian works, for example, being favored with cheap water power, was reduced only from 80,000 tons capacity to 50,000 tons output. The mathematics of the world market were made the basis of the understanding, while those who held the key to the situation, by virtue of cheapest production and marketing facilities, did not ingist on annihilating their less favored competitors. Now that the worst is over, thanks to the new demand for acetylene in the metal and steel-working industries. Rovue des Eclairages devotes a hopeful article to this interest-ing situation. It says in substance:

"The progressive use of acetyisms for illumination has after all been remarkable. The heady-does industriable has in 1804-1810 shows fits ralify by the manner in which it has progressed in all countries, despite the sharp orising paised by the carbide factories. One must include in the view all that has taken place in the past fittens years he will that has taken place in the past fittens years he will then he headway made in the missing with the past fittens and the past fittens are not the past fittens and the past fittens are not the past fittens and the past fittens are not the past fittens and the past fittens are not the past fittens and the past fittens are not the past fittens and the past fittens are not past fittens are not past fittens and the past fittens are not past fittens are not past fittens and the past fittens are not past fittens are not past fittens and the past fittens are not past fittens are not past fittens and the past fittens are not past fittens are not

ent when gas and electricity were in full flower. The Weisbach or incandescent mantle system bad coal gas a formidable competitor for electricity and the latter, spite of its high cost, already enjoyed a vogue which has since only been accentuated. It was therefore difficult for a new illuminant to win en a modest place, but the tenacity of the promoters of acetylene (aided by the adventitious demand for strong and windproof light for bicycle and automobile lamps) brought the new gas past the critical stage. The balance sheet of the industry already shows an imposing total. Calcium carbide is now an important product of electrochemistry Nearly 250,000 tons is produced annually at 75 factories, and represents a value of 70 to 75 million francs. There are 500,000 stationary generators in use and millions of portable generators or lamps. In 900 little towns, counting from 1,000 to 10,000 inhabitants, this special illuminant provides the municipal light Installations in the lighthouses of the coasts, in railway stations and coaches, in signal stations and in ships, are all proof the vitality of the acetylene system. In all branches of industry, in agriculture, in the art of war, in medicine, in navigation, and indeed in all branches of the activities of civilization acetylene has rendered immense services. One can no longer deny that this gas is destined for a still greater future. A light source which is employed in all five parts of the world, from Europe to Oceanica, in the colonies, in the most remote and isolated islands and even toward the poles, cannot be the dangerous explosive on which too many people have chosen to throw dis-credit. Wherever acetylene has shone with its brilliant white luminance it has produced surprise, satisfac-tion and economy. Neither coal gas nor electricity can, like acetylene, be produced economically in any loca tion and independently of the industrial conditions of

Dwelling on the impetus which the acetylene industry is new receiving from the advancement of autogenous welding, which "blds fair to revolutionize metallurgy." the "Revine des Zioloringes also finds ocussion to refer to a report of the United States Lighthouse Board which was quoted at the acetylene congress in Chicago in August, and according to which a kerosene burner of fifty candio-power costs the government 5,700 frames per year to maintain, by reason of the necessity of employing a light keeper and providing a habitation for the latter, while the same candle-power can be maintained for 75 francs per year by means of stored acetylene gas

A Sound-proof Room

THE Physiological Institute of the University of Utrecht possesses one of the most remarkable rooms in the world, a chamber about seven and a half feet square, which is said to be absolutely noiseless, as far as the entrance of sounds from outside is concerned

This room is situated on the top atory of a laboratory building, and is an inside room, but so arranged that it can be ventilated and inundated with sunshino The walls, floors and ceilling each consist of half a dozen layers of different substances, with air spaces and interstices filled with sound-deadening materials.

materias.

Some persons when in the room experience a peculiar semastion in the ears. While every effort has been made to exclude sounds that are not wanted, of course the object of constructing this singular room was to experiment with phenomena connected with sound. Some of the sounds employed are made in the room itself, others are introduced from outside by means of a copper tube, which is plugged with lead when not in use.

A New Potato

DURING the past two or three years remarkable progress has, it is said, been made in the cultivation of a new species of potato in the department of Vienne in France.

This potato originated in Uruguay, and is called the Solomum Commersoni. In its new environment in France, and by reason of its careful cultivation and selection, it has developed several forms that promise to become fixed, and to possess much value as additions to the food resources of Europe

Among these forms, all springing from one parent species, there are a yellow variety, a white variety as red variety, and a variety not specially characterised by color, all of which possess distinctive shapes and qualities. A fact that expecially interests botanists and cultivators is that these varieties have ovidently not yet reached their final settled forms, and the experiments in Vienne are closely watched because it is thought that they will throw light upon the unaettled question of the general origin of the most of the property of the content of the property of the variety of the property of the content of the property of

The Eighth Motor Boat Meeting at Monaco

By the Paris Correspondent of the Scientific American

A FTER the numerous aeroplane flights that have taken place in France so far this year, it was a stelled to the sports men of the world to gather at Monaco once more in order to witness the sighth annual motor boat raves. After the phenomenal speed exhibited in the Solent by the new british beat "Sulpel Leaf III." a mouth or more ago, it was expected that extraordinary bursts of speed would be shown by the racers at Monaco, but in this, motor boating enhusiatis were disappointed as there were but few racers, and as most of these broke down and

alones
At the opening of the meet on April
3rd, several competitors went into the
races without having their craft properly prepared Moreover, the sea was
rough, and as a result of this the "PlekAss VII" was overturied by a large wave
and its owner, M Ruddojh Hertzog, and
his when were obliged to climb
up on the bottom of the beat until they
were rescued and their craft was towed
to a wharf

falled to make any remarkable perform

The first for all race (one round of the 525-kilometer or 3.88 mile course) was participated in the first day by but one racer—the 'Maple Leaf III,' which completed the course in 17 minutes, and also by the following crusers in the third, fourth and fifth classes, viz. Third class (28%-foot hulls, having 4-vylinder motors of 100x106 millimeters 3.3374. 3.360 inches—bore and stroke) 1, "Excelsion XIV." 71 18 (1345 miles per hour), 2, "Sultane," 16.55, 3, "Cesar," 31:211.4. "Naval," 32 42

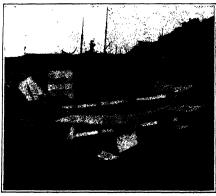
Fourth class (28½ to 39 1/3-foot hulls having 4-yilinder motors of 130 mm - 4055 inches born) 1, "Lurssen Daim ler," 8 46 (26.68 miles per hour); 2 "Femina," 24 49, 3, "Elle," 27 27; 4, "Utile 1," 28 11

Fifth class (39.37 to 58.95 foot hulls, having 4-vilinder motors of 155 millimeters—4.152 inches-bore 1, "Chanteler 1," 10.13 (22.29 miles per hour); 2, "La Quise," 10.25. The racer "Ursuill" of the Duke of Westminster broke one of her propeller shafts, and the propaller perforated the hull. Nevertheless, she was able to reach shore under her own power with the other propeller.

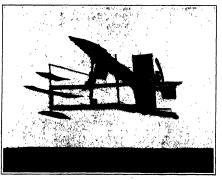
The second day the weather was much better, and the bulance of the freefor-all race, 1 e., for cruisers of the flist and second classes, and for some of the other racers, was run off. The results were as follows. Cuisers of the first class 1. "Hispano Sulza," to 50, 2. "Excelsion XV." 12 01, 3. "Passal fort"; 4. "Steme", 5, "Stemen", 6, "Chella Merlem" Second class 1. "Gresoire IX." 9 24; 2. "Gregoire X." 9 46, 3. "Excelsion-Segmen"; 4, "Voltheuri", 5, "Lisette"; 6, "Vedette du Carlad." Racers, first class: 1. "Labor V." 7 47; 2, "Miranda," 7 54

The final handicap, consisting of two rounds of the course, or a total of 7% miles, resulted as follows: 1. "Gregorie IX." 18 04 (25.70 miles an hour): 2, "Hinsenson States." 29:22; 3. "Hinsenson Tables." 14:46 (31.35 miles per hour); 4. "Excelaire XV." 19:00; 5. "Chairle," 17:33; 6. "Maple Leaf III." 14:24 (32.36 miles per hour).

In the afternoon of the second day M. Becue experimented with the Fabre hy-



Side view of Fabre hydro-aeroplane at rest upon the water.



The Fabre hydro-seroplane before-



And after she struck the ruchs.
THE MONACO MOTOR BOAT BACES

dro-aeroplane, frequently rising from the water and making evolutions in the air. The meet was delayed for a day on account of bad weether, but afterward the weather cleared and the 80-kilometer (31.08-mile) race for the 81,000 prise of the International Sporting Club was run upon a smooth sea. The results of this race were as follows: Racers of the first class: 1, "Hispano-Suiza," ih. 47m. 18s.; 2, "Excelsior XV." 2h. 20s.; 3, "Sed-wise"; 4, "Mistral"; 5, "Simone." There were nincteen entrants in this class. The racers of the second class finished as follows: 1, "Sigma-Labor," h. 13m. 40s. (2530 miles per hour); 2, "Labor V." 1b. 22m. 18s. "Miranda" and "Kangouroo" stopped on the fourth round and were not placed in the race.

The chief race of the entire meeting, the Championship of the Bea, was held on Sunday. April 9th, and no less than 51ty-two bosts were entered in this event for crutisers. The distance was 200 kilometers (124 2 miles). The race was won by the Gernam bost, "Lisreso-Dainler," in 4 hours, 43 minutes, 17 seconds, which is equivalent to an average speed of 28.00 miles an hour. The prize was \$1,200. The only other boats to fisish the Face wore "La Quisa," of M Deperdussin (5 hours and 28 minutes), and the "Pick. Ass VII." (6 hours, 22 minutes, 28 seconds)

It was a noteworthy fact that all three of these boats were equipped with German motors, the winner having, of course, a Daimier engine, and the other two having Mercedes and Durkopp motors respectively. The "Udarsen Daimier" had a fid-bottomed hull of the type used in the Prince Henry cup race. The "La Quise," built by the French constructor Pitre, had a similar hull, with a perfectly flat bottom, rounding upward at rifle toward the bow. Her motor was of less power than that of the winning boat, but she made good speed nevertheless, and the motor ran without a hitch for the 5½ hours. While M Deperdussin was piloting his boat in this race. Vidart, on his Deperdussin monoplane, flew from Nice to the scene of the races at Monaco, and performed evolutions above the racers. This event is shown in one of our photographs.

tions above the Tareers 'inis event is shown in one of our photographs. On April 10th the 'Prix du Tir aux Pigeons,' the 50-kliemeter race for cruisers, was run off, the winner being 'Gregoire X.' of M Hinstin, which finitable the race in 1 hour, 14 minutes, 38 asconds—an average speed of 24% miles an hour. In this race for cruisers, the superiority of the new Gregoire motor, which has a bore of 30 millimeters (3.84 laches) and a stroke of 300 millimeters (1811 inches) was demonstrated.

The "Prix du Monaco" for racers of the second class was a walkover for the "Ursula." in 48:57. This craft had been repaired after her accident on the first day, and ran this race in good order. Unfortunately her only compstitor, the "Clement-Deepuplor," was not in comunission for this race. She was Sited with the 135 horse-power 4-cylinder meter formerly in the Clement-Bayard sirahio. This was mounted directly upon the hull of the boat, and the shocks and witherstoo of the bydroplane broke one of the lugs off the crank case, and made it necessary for

have a new crank case before the boat single be gut in commission again. One of our phicographs shows this boat at till agest when viewed from the rearfale is a typical encestor hydropiane, and her hull has a peculiar curved shape as

The afternoon of April 11th a strong sast wind arose, and it was only possible to run two races early in the afternoon. These were the "Prize of the Mediter-ranean" for cruisers of the third class, and the "Prix de la Cote d'Asur," for cruisers of the fourth class. The distances in both races were 50 kilometers.

The "Labor IV." won the first race in 1 hour, 4 minutes, 32 seconds (28.87 miles an hour). She beat by 8 minutes the time made last year in this race. This boat is a hydroglane with one step. In the other race just mentioned, the

In the other race just mentioned, the "drawen-bainer" dislated first in 1 hour 8 minutes, in spite of an accident to the magneto, which was repaired during the course of the race. The hydropiane "figma-Labo" was running in second place, and was within half a mile of the faish when the pump chain broke and lost her the race. "Labor V." however, obtained second place

The chief remaining events were the "Coupe des Nations," on April 16th, and the "Coupe du Prince de Monaco," on the following day.

The first-mentioned race was ruf on April 18th, and was won by the "Ldrasen-Daimler." her time being 2 hours, 1 minute, and 20 seconds, for the 621 miles This is an average speed of 30.7 m. p. h. "Chantecler II." was second, with an average of 18th miles and the second of 18th miles and the second of 18th miles and 18th

Despite the fact that the British boats had undergone a continual run of break-downs and ill luck, the "Treuks" finally sucreeded in winning the "Coupe de Prince de Monaco" on the last day. This race was won in 2:34 1/5 over a course of 2:582 meters (about 1:54 knots)

The principal movelty at the meeting this year was the Fabre hydro-aeronlane, the "Goeland" This made a number of excellent flight, starting from and allghing upon the water with the greatest ease On April 12th, while M. Fabre was flying her, he was obliged to descend quickly, as the wind was carrying him near to the ends of the piers. The front float struck on the creet of a heavy swell, and the machine tipped and struck it right wing against the rocks. It was badly damagnd, as will be seen from one of the understands.

From the fact that the British race: "Urusia" made a round of the course in 5 minutes, \$72/5 seconds, which is almost exactly \$8 kmots, and also on account of her haring Breken her record of least year (5 minutes, \$10 4/5 seconds) by revering the course in 5 minutes, \$13 5/5 seconds—a speed of well over \$8 kmots—it is supposed that the course was mader the official figure of \$25 kitometers in longth A complete circuit was not made in most lastances when the boats were timed while racing, so that the records above ever, the more nearly accurate the above records must be. It is probable that the experience obtained by the English with the racer "Maple Leaf III." will stand them in good stead when it comes to competing in the race for the Harrasworth, outp, which will be held in Long Dishad South eart August.

The state of the s





"Lürssen-Daimler" Racing.

Stern of "Maple Leaf III.



"Lüresen-Daimler," winner of the "Championship of the Sea," viewed from the rear at full speed.



M. Deperdussin piloting "La Quise" while Vidert is flying a Deperdussin monoplane overhead.



"La Fleche," a step hydroplane built about a regular hull.



"Clement-Despujel" at full speed on the Seine.
THE MONACO MOTOR BOAT RACES

Possibilities of the Automobile

A UTOMORILES have been utilized in various ways as auxilityr powers. The Editor of this journal once used his electric automobile to light a church Partners use the automobile to drive wood-awing mathines and churns. The increasing opularity of vacuum cleaners for domestic use and the necessity of a reliable power for maintaining the vacuum suggest the desirability of some inexpensive attachment or fitting for application to automobiles to adapt them to supply the power for operating the vacuum pump. Possibly a simple pump night be incorporated in the automobile were to be that when the automobile could be sufficiently and the supply the power for operating the vacuum pump. Possibly a simple pump night be incorporated in the automobile so that when the automobile owner atopsed his machine the front of his home to opin the sufficient primaries.

Counterfeit Coins and Baby's Bank

THE cashler of a prominent savings bank is responsible for the state ment that a goodly sum of bad money annually finds its way into babies' banks At first thought this would seem to indi cate a mean spirit on the part of grown up folks to take advantage of innocent childhood, but the reason given by the cashier mentioned seems to set aside that impression Many of the savings banks distribute small metal banks among their depositors. The keys to these are kept by the bank, and the money once dropped in the metal bank is accessible only to the parent institution. This is a very popular form of encouraging saving, and very few young couples who have a baby are without one of these little banks, conveniently placed to receive the spare coins which so quickly swell into large sums for the growing son--or daughter -and helr. These banks are brought to the receiving teller to be emptied and the contents credited to the depositor. That is the time when the teller has to watch out for counterfeit coins. It is seldom, indeed, that one of these metal banks does not contain at least one counterfell coin. His theory is that lead nickels and quarters and dimes come to almost everybody in the course of time. and those who keep metal banks seem to have an idea that in counting out a large number of coins the teller is apt to overlook a counterfeit. Frequent resort, however, on the part of depositors to this way of making good the loss oc-casioned by the receipt of a bad coin has casioned by the receipt of a had coin has rendered the teller's eyes sharper and he looks more intently at the numerous coins dumped on his deak from the "baby's bank" than he does at the ordinary grist that comes to his mill Of course a coin sodiscovered is courteously returned to the depositor, who generally murmurs something about "not noticing it was bad," and goes on his way, but the regularity with which such incidents occur has convinced cashiers and tellers that sooner or later all counterfest money finds its way into some baby's bank.

The Current Supplement

THE current Supplement, No 1844, contains, among other striking articles, an authoritative explanation by a German naval officer of the accident that ppened to the German submarine boat "U 3." on January 17th last, and the manner in which that unfortunate vessel was salved -An artificial method of foreing basket willows is described -- Prof gust Weismann's splendid essay Charles Darwin is continued—Mr. A. Morehouse presents the second and con cluding installment of his paper on "The Reclamation of the Southern Louisiana Wet Prairie Lands" Mr Robert Grimshaw presents a digest of the work prepared by the German Association of a Manufacturers on the subject of ceilings and girders —A gravity surface for the handling of bricks is described by Mr Frank C Perkins

Science in the Current Periodicals

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

The Application of Mathematics in Science

EVERY good and perfect gift is sure to be abused in the hands of some who lack either the skill to properly handle the tool placed in their hands, or the right spirit to appreciate its worth There are those who bring discredit upon the value of mathematics in the service of science by their puerile endeavors perforce to turn to account in their work what facilities they possess in mathematical discipline, to force into the garb of a mathematical formula some irrelevant feature, some supposed numerical relation

It is perhaps in part cases of this kind that Prof. Sedgwick-Minot had in mind when he said, in his address before the American Association:

"We biologists can not deplore too frequently or too emphatically the great mathematical de which men often of very great, if limited, ability have been misled into becoming advocates of an erroneous conception of accuracy The delusion is that no conception of accuracy The delusion is that no science is accurate until its results can be expressed mathematically The error comes from the assumption that mathematics can express complex relations Unfortunately, mathematics have a very limited scope and are based upon a few extremely rudimentary ex-periences, which we make as very little children, and of which probably no adult has any recollection that from this basis men of genius have evolved wonderful methods of dealing with numerical relations should not blind us to another fact, namely, that the observational basis of mathematics is, psychologically speaking, very minute compared with the observa-tional basis of even a single minor branch of biology Moreover, mathematics can at the utmost deal with only a very few factors, and cannot give any comprehensive expression of the complex relations with which the biologist has to deal. While, therefore, here and there the mathematical methods may aid us, we need a kind and degree of accuracy of which mathematics is absolutely incapable. For our accuracy it is neces sary often to have a number of data in their correct mutual relations presented to our consciousness at the same time, and this we accomplish by the visual image, which is far more efficient for this service wish to understand a group of complex related details, such as an anatomical structure, we must see them, and if we cannot see them no accurate concep tion of the group can be formed constituted as they actually are, we cannot anticipate that there will ever be a mathematical expression for any organ or even a single cell, although formula will continue to be useful for dealing now and then with isolated details Moreover, biologists have to do with variable relations, some of which of course can be put into mathematical form, but we find that even simplest variations become clearer to us when sented graphically. The value to every student of presented graphically. science of the graphic method has been immense. Biologists can work to advantage with quantitative methods, we welcome the increasing use of measure-ments in biology, we welcome the English journal Biometrika, the organ of the measuring biologists but none the less we refuse to accept the mathematical delusion that the goal of biology is to express its results in grammes, meters and seconds. ments furnish us with so-called "exact" records, but the alm of science goes beyond the accumulation of exact records to the attainment of accurate knowl edge, and the accuracy of our knowledge depends chicfly on what we see The practice of science con-forms to this principle, the definite affirmation of which may prove of continuing advantage.

which may prove of continuing advantage."
We cannot help feeling, however, much as we admire Prof Sedgwick-Minot's forceful sayings and bons mosts that his attictures on this matter are at little too severe. We call to mind a saying of the great English physicles, Sir J. Thomson Referring to the feeling which seems to exist among certain men of celence, who appear to hold it a virtue for a man to be "unmathematical," Sir Joseph points out that if, this be indeed a virtue, it surely is of all virtues the scalest. We doubt if any put a mathematician of the highest order, a man like J. J Thomson or Karl Pearson, is fully qualified to discuss the possibilities and limitations of mathematics as applied to the several branches of science. The dictaise of common sense would seem to concur with the practice of the best authorities to the effect that wherever mathematics can be successfully and usefully applied, wherever a complete judgment of the question at issue is

impossible without precise mathematical analysis, there is it indeed true, that "no science is accurate until its results can be expressed mathematically," and there mathematics must be applied regardless of any prejudice that may exist against the expression of results in "grammes, metars and seconds."

Pseudo-fabrics.

A FRENCH manufacturer of artificial silk has refabric, which is sold under the name of silk gause. The material resembles other fabrics made of arti-



Fig. 1.—Specimen of mando-fabric, magnified.

ficial silk in its brilliant luster and its lack of strength when wel, but carvoul examination with a magnifying glass shows that it is not composed of threads interlaced or worst negether, but forms a continuous net of uniform thickness (Fig. 1), the fibres of which are fused or wided together at their junctions (Fig. 2). In short, it is not a woven fabric, but a passed-feabric.

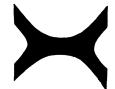


Fig. 2.—A junction of fibers, greatly magnified.

M. A Chaplet, who describes this new material in a recent issue of La Nature, refers to previous articles describing various processes for the production of similar pseudo-fabrics which have been patented in recent years, but he adds that none of these methods has been found commarcially practicable, and that the forms and inequalities of the elements of the new material prove that it is not made by any of

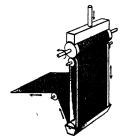


Fig. 3.—Diagram illustrating the principle of the method of producing pseudo-fabrics.

these processes. Although the secret of the production is jealously guarded, M. Chaplet has successed in discovering the principle of its manufacture. The method is especially interesting because it differs widely from all methods already known and described.

The continuous net which forms the gause is molded

upon a metal cylinder engraved with the groeves arranged in a pattern similar to Fig. 1. This cylinder rotates in contact with a wessel filled with a solution of cellulose (Fig. 3), and the grooves are thus filing with the viscous solution, any stoose of which is armoved from the cylindrical surface between the grooves by suitably arranged rollers and compara. The cylinder is also pressed firmly along another element of its surface, against an endless carrying band to which the network of cellulose pasts is thus transferred. This part of the operation is not accomplished without difficulty. In order to detach the soft issue from the cylinder and transfer it to the carrier regularly and without tearing, it must be carriedly started at the commencement of the rotation, and the viscosity of the mass, the character of the receiving surfacé and the temperature must be nut right:

The endiese band is stretched over a pair of rollers of which one is pressed against the casting critical and the other rotates in a trough which contains a coagulating bath (Fig. 3). In its passage through this bath the pseudo-fabric, sincardy somewhat solidified by evaporation, but still very weak, is hardened and strengthened so that it can be detached from the carrier and drawn off to one aids over a third roller (Fig. 3). It then passes through a hardening bath of formol, and through dyeing baths, if a colored fabric is desired, and is finally dried. The collekes colutions, and the fixing, denitaring, figure-ording and other baths do not differ essentially from those among an other baths do not differ essentially from those among an other baths do not differ essentially from those among an other baths do not differ essentially from those among an other baths do not differ essentially from those among an other baths do not differ essentially from those among an other baths do not differ essentially from those among an other baths do not differ essentially from those among an other baths do not differ essentially from those among a supplication of the same details with the same details as the same detail

The process is very ingranious, and its result is antifactory, but its field of userbliness is very limited in practice, gauses and tulles are the only fabrics that can be successfully imitated by this method. An artempt to imitate the closely-woven slik fabrics that are most extensively used would result in the production of a continuous fill one sheet of cellulone, having none of the pseuliar characteristics of a woven fabric. Even if the closely-laid fibers could be kept separate, the impossibility of relative motion at their intersections, where they are welfed together, would deprive the pseudo-fabric of the facibility, extensibility and elasticity of a woven fabric.

Hence the industries of spinning and weaving are

Hence the industries of spinning and waving are not threatend with extinction by this invention, but they may find a formidable competitor in another process, which is still in the experimental stage, and which is based on the spontaneous formation of this fibrous felted tissues in solution of viscose in certain conditions.

In 1734, when the celebrated naturalist Réaumur predicted the manufacture of artificial silk, he also foreaaw the production of pseudo-fabrics. The rapid development of the artificial silk industry gives reason to expect that pseudo-fabrics of real utility will soon be produced.

Cryptogamic Maladies of Cereals

THE steadily increasing public appreciation of the vital importance of the purity of food supplies makes especially timely an article on the deleterious effects of fungus growths upon cereals, recently contributed to Common.

Thus the use of bread or flour made from ergotic rye causes a gangrenous or convulsive mainty called ergotiam, a disease formerly epidemic after very rainy seasons.

In Silesia and in Saxony in the sixteenth and the seventeenth centuries it was a fearful sourge, and at various periods since has been rife in other parts of Europe, owing to the carelessness or dishonesty of Armers in not separating the diseased from the sound grain.

Wrgotic bread is slightly violet in color, unpleasant of odor, and bitter and unappetising of taste.

When the ergot is sufficiently abundant it is revessels by the microscope. When present in very small
amounts it may be detected by the following method:
Boil some of the flour in alcohol mixed with a few
drops of hydrochloric acid and allow it to stand. The
liquid will be of a red tint, more or less intense according to the amount of ergot present. Gue-Bail of
one per cent may be determined by this process;
From three to five per cent is sufficient to cities-ierfor
one tileses, which sometimes terminates to destifi
animals also often fall victions to infected gratia.

Cereals are subject to stated, met out by come; tell

the constant growth. Rust is caused by secure failed of indeceeded fangl of the genus process. This improvement fangl of the genus process. This improvement process are redden, watch we know to the process of somewhat brown, which are found on the leaves and shinly of the grain as well as on the care. This funguas grows at the expense of the plant, which is thoughter defective. The grains shrived and remain almost sunger. The strew loses color and door, and becomes failtrium to an instant. The empiric wisdom of the farmer's has long accused the barborry of causing this affection, and as early as 1660 the Parliament at Roissa, archered the destruction of these shrubs throughout Normandy.

Modern botanical studies of the Puccinio have been found to justify this popular belief. If we examine a rargy isat of the barberry we find at its base a sort of reversed cup bearing on the upper part of its how a membrane whence spring the rows of spores of the rust called occidium. If one of these spores be placed on a leaf of wheat or other occasil in the proper conditions of heat and humidity, it will soon germinate and a myedium will develop is the plant. Soon after, microscopic rods which carry at their tops tiny yellowiph rounded bodies, appear on the leaves, stalks, or ears. These give to the red rust of grain its characteristic aspect and secure its dissemination.

To sum up the matter briefly, the Puccinia gramints can not complete the cycle of its metamorphoses without two vegetable forms, the cereals and the barberies. Hence the suppression of the latter will stop the ravages of this plague.

the ravages of this playes.

Another Fucciois attacks wheat, oats, barley and
rys, but its cooldsom develops only on the lycopodium
or some other member of the family of Berginacov.
If passes through an identical vital 'cycle, but its
corange colored spots form straight lines parallel to
the value of the leaves instead of developing without
apparent order.

To combat rust, it is necessary to destroy both barberries and Borapisaces. Care must be taken to avoid an excess of attrogenous fertilisers, which favor the increase of cryptogamous entophytes, and to cultrate varieties enjoying an immunity more or less complete from rust, such as hard wheat and St. Helen's wheat.

What cerries or rot, often wonsty confounded with smut, is likewise due to a fungus which invades the owity of wheat, illing the grain with its spores, witch form a black powder of fetid ador. This sometines causes the loss of from one-half to three-quarters of the harvest. When the ears issue from the sheath they take on a bluish-green color and ripen before the others. The affected grain has a characteristic nauseous exhalation.

It is a member of the same family which produces anut, which develops like cories, but whose black spores are finer and odorless. This attacks chiefly barley and cats, and exerts its ravages on the parechyma of the glumes When the wind has blown abroad the powder of the spores, the ears are left mere blackened skeletons. Happily both caries and smut can be prevented by the sulphur treatment. Another parasite, the Ophicolosis growings, invades

Another parasite, the Ophicolous prawsist, invades the joints of wheat stalks that are nearest to the earth. As the stalks are thus weakened the grain falls even in a very moderate storm. The best method of combating this trouble is sparse sowing to obtain vigorous plants and increased application of phosbates.

Finally we may consider the fight against ergot aiready referred to as the most serious disease of rye. This fungus, Clausiceps purpures, develops on the overy, principally in wet season. The place of the grain is taken by an excressonce resembling the spur of a cock. It mycolium is of a special form, enabling it to resist conditions unfavorable to vagetation. Falling on the ground during harvest or introduced by badly cleaned seed, it awaits the month of May to tructify, when it preduces they rounded bodies at the and set a peduncle. From the whole surface exide annal steps after clear large the services of the type produce another form of the fungue.

dues another form of the lungue.
The yellowish thements of the mycelium gradually penetrate the walls of the owner and take the place of the latter. To grevent the spread of the disastrous pursuits, the fast duty of the farmer should be to sift and nort the seed caractally. Then the rye should be used to the thements of the wild cereal in the vicinity in. which the sperse of the fungus might feature.

Hardware in the Stomach

FURTH time to time there appear in the medical formeds extraordinery catalogues of foreign bodies found, instally at meriupay and much less often at specialities, within the stimulation of the found in agreement of the tolerated by the

- Call 2012

stonach for long periods of time is surprising enough, were wise they consist of soft and yielding substance, such as the hair which becomes matted together to form a hair-hall; but when post-correct examination of reading substance with the post-correct within the post-correct within the constant and a multitude of metallic objects, ahery, rigid, difficult to swallow and dangerous to retain, the only possible explanation of such an extraordinary insensitiveness must be found in the fact that the metal-explorer had been demented for years. The London Loncer tracts are the correct as truly remarkable instance of this insame propensity in the case of a mulatic woman, aged 33 years, admitted in 1903 to one of the Missouri State hospitals with acute mania, ending in dementia, and caused by excess in cocaine and morphis.

"From this time until September, 1910, when she ed in the hospital, she never showed the least sign of disease of the digestive system. The attendants often saw her picking up nails and pins, but no one had seen her swallow any. Death was due to nephritis, and until a week before her death she never refu her food. Dr. A. H. Vandivert and Dr. H. P. Mills. who made the necropsy and reported the case in the Journal of the American Medical Association, were surprised to find the fundus of the stomach stretched wn in a long pouch which reached into the left iliac fossa and adhered to the parietal peritoneum in that region. In this sac lay a hard mass which proved to consist of a large number of foreign bodies, leaving a narrow channel for the transmission of food along the lesser curvature. Adherent to the peritoneum of the stomach was the great omentum, remarkably thickened, and inclosing a number of small abscesses bodies had made a way through the wall of the stomgeneral peritoneal infection being averted only by the omental adhesion. The mucous membrane of the stemach was atrophic throughout, and ulcerated in patches; the submucosa was infiltrated with round cells, and the subserous connective tissue exhibited a general dense fibrosis. Ulcers and widespread erosion were also seen in the mucous membrane of the cesophagus. In addition to the foreign bodies in the stomach there was a needle in the escophagus and another at the base of the left lung. The foreign bodies in the stomach weighed 2,268 grammes (5 pounds avoirdupois) in the aggregate, after thorough washing, and consisted of 453 nails, 42 screws, 136 ordinary plus, 115 hair-pins, 105 safety-plus, 52 carpet tacks, 63 buttons, and a miscellaneous collection of boits, metal nuts, teaspoon handles, thimbles, needles beads, coat-rack hooks, fruit seeds, stones and pieces of glass, and all sizes and shapes of similar objects. the total number being 1,446. The writers have arranged this scrap-heap in rosette form for purposes hotography, and have thus achieved an narily vivid picture of the possibilities of the human

Emotions and Morals

A PAPER read by Dr William Brown at a resent meeting of the British Psychological Society is reported upon in Notaro, from which we reproduce the following account. The subject of the discourse was "Emotions and Morale". After a brief survey of the views of acriler writers on the nature and classification of the emotions and their relation to ethics, in which, however, the doctrines of Artisotic and Adam Smith ("Theory of Moral Sentiments") were treated at some length, the speaker proceeded to discuss the meaning of the terms "passion," "emotion," and "sentiment" in relation to the theories of Ribol, Shand, and McDougall According to ordinary uses of the term, and also to its etymology, passion would seem to indicate an uncontrollable state of mind, in the form either of an actual emotion or a system of emotional tendencies. Although Shand's employment of the term sentiment to express the conception of "a system of emotional dispositions centered about the idea of osme object" would theoretically cover the latter of these two uses, passion seems to be a more appropriate and expressive word to indicate those systems which are uncontrollable by the rest of the mind, and issue, under appropriate conditions, in uncontrollable emotions, e.g., "a passion for politics," "a passion for the stage."

The word sentiment, as used in literature, has acquired associations of weakness or plandidty which constitute a slight drawback to its use in scientific psychology to cover all cases included in the technical definition of Shand above mentioned. "Tender emblon." Identified by Ribot and McDougall with the parental institute, seems to have a wider connuctation, and receives more adequate treatment from Shand. In particular, the element of tenderness or pathos present in many seathetic emotions has little connection with the parental Institute.

The question of "emotions and art" was treated at

some length, with special reference to music and the drama. Nother the sensationalistic nor the formal-siste theory is adequate as an explanation of music. The ancient Greeks were right in regarding music as "the proper language of the emotions," but it is important to realize that the emotions of music are not, strictly speaking, identical with the emotions of every-day life. They are analogous to the latter, and this explains the appropriateness of the music to the words in opera, but they really belong to a world of their own and possess a meaning of their own This is why the music of an opera, even when entirely appropriate to the words, may transcend them in such a way that elements of grossness in the story entirely lose their real "works-day" significance in the total presentation. The "failome" of Strauss is a striking illustration of this.

As regards the psychology of acting, the important satatistical investigation carried on the Nr William Archer, the dramatic critic, more than twenty years ago, is the only work of definite scientific value hitherto produced. Mr. Archer's chief purpose was to test the paradoxical view of Diderot, accepted by Coquelin, but rejected by Sir Henry Irving, that stage emotion should not be real, and that the roully first-class actor should be a man of little or no "sensibility". The results showed that in almost all cases of first-class actor in England, not only did the principal signs ago for real emotion—real tears, blushing, pallor, etc.—occur, but the artists experienced genuine emotion, and often found real emotion from their private lives help them on the stage by mingling with and intensitying their festioned emotion. A state of dual consciousness while acting was found to be common, but not universal

Mr. Archer adds many further comments of considerable psychological value, and predicts that the subject will be taken up some day by trained psychologists and subjected to an exhaustive discussion

As an illustration of many of the points raised by Mr Archer, a letter very kindly written by Miss Ethel Irving as a reply to a query as to her state of mind when playing intense emotional parts, was quoted and discussed, and a general theory of stage emotion was sketched out and illustrated by a brief description of Miss Irving's recent emotional acting, especially in Henry Batallie's play, "Dame Nature."

Green Water of the Nile

THE "green water" of the Nile is quite a different thing from the green water of the ocean About April 15th the Nile begins its annual rise, and a month later the effect is felt at Khartum A

About April 16th the Nile begins its annual rise, and a month later the effect is felt at Khartum A very curious phenomenon accompanies this increase, in the appearance of the "green water"

For a long time it was believed that the color came from the swamps of the upper Nile, lying isolated and stagmant under the tropical sun, and, oiluting the waters with decaying vegetable matter. With the spring rise this fettle water was supposed to be swopt into the streams to make its appearance in Egypt

Within recent times, however, this theory has been bandoned Now, we are advised, the green water is caused by the presence of immunerable numbers of microscopic alga, offensive to the taste and smul They originate away up in the tributaries, and are carried to the Nile, where under the hot sun and in the clear water they increase with amandar rapidity, forming columns from two hundred and fifty miles to five hundred miles in length.

The weeds continue to grow, die, and decay until the turbid flood waters put them to an end, for they cannot exist except in clear water

Offensive as, in some respects, the green water is, it is halled with delight by the Egyptians, since its appearance is a sign of the real flood time and the close of the water famine.

Known by Their Sparks

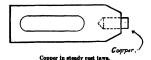
EXPERIMENTS made in Budapest have shown that the spark rays made by the incandescent particles thrown off from iron and steel when put upon an emery wheel afford a means of testing the composition of the metals.

Carbon steels, manganese steel, and steels containing tungsten and nickel, each give a characteristic spark, of different forms and colors, which are easily datinguishable. The form of the spark picture changes with the quantity of earbon. Even so slight a difference as 0.01 per cent of carbon, it is said, can be detected in this manner Funited branch high lines denote carbon steel; tool steel shows the appearance of "folosom" on the branches; tungsten steel gives red streaked rays and shining points, with little balls thrown out of the formation, and an explosion appearance in the articulation denotes the presence of molybdonum, vanadium or titaluum.

ONE of the readers of Handy Man's Workshop Owishes to know of a simple method of centering and reboring an engine cylinder in a lathe. Instead of replying to the question himself the Editor has decided to call for suggestions from other handy men.

Copper in Steady Rest Jaws By H. D. Chapman

W HEN using the steady rest in lathe work, I have always had a lot of trouble because the jaws cut into and mar the work, especially brass work. I have tried bard wood jaws and other materials with little success, as they will wear away in a very short



time, so finally I tried drilling a hole in the end of the laws and used a round piece of copper. The piece jaws and used a round piece of copper. The piece was turned to fit nearly into the hole in the jaws. The copper was annealed so it would be soft. This little kink worked to perfection.

Planing a Cylinder Surface on a Lathe By O. Ruehmer

A PLANER has many points in common with a lathe. For instance, the tool remains stationary while the work passes under it, and similarly in a lathe the tool remains in fixed position except when

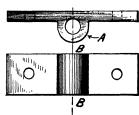


Fig. 1.—Casting to be finished all over.

moved to take a new cut, while the work revolves be fore it The lathe, however, is more adaptable than the planer, and by keeping the work fixed and moving the tool with the usual feed mechanism, it is possible to plane a piece of work in the lathe. When thus employed its action is very similar to that of a shaper The accompanying illustration shows an interesting bit of planing that might have been done on a shape though not so easily as with the lathe The work consisted of a casting, plan and side views of which are shown in Fig 1 This was to be planed all over, and

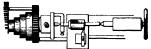


Fig. 2.-Using the lathe as a shaper.

the problem was to finish the cylindrical surface A. The casting was mounted upon a mandrel, the axis of which was made to coincide with the axis of the cylindrical surface. The mandrel was formed with a collar to take the thrust of the tool. The mandrel was then mounted in the lathe centers, as shown in Fig. 2. The back gears were thrown into mesh and the lathe head was locked. The tool rest and slide rest were then moved by hand, allowing the tool to take a light cut off the round part of the casting. By mov-ing the head around slightly after each cut, the casting was turned to a perfect half cylinder in much less time than would have been taken had the work been done in a shaper.

Lubricating Iron Planes By Albert F. Bishop

W HEN using an iron or iron-face plane the work-man is apt to notice a disagreeable suction or repelling action which makes it necessary for him to use more force in handling the tool than when using



Iron plane on a lubricating tablet.

the wooden plane. Slight lubrication will make the plane work very easily, and the following may prove a useful suggestion in this connection Take a piece wood about a foot long and 3 or 4 inches wide by inch thick. Tack on two thicknesses of baise or a % inch thick. piece of thin felt. Draw the baize taut and secure it with tacks driven in the ends of the piece of wood so that they will be out of the way of the plane iron. Put a small quantity of oil on the baise or felt. In use, the baise will need a little oil from time to time. Now the workman simply lays his plane on the felt pad instead of on the bench; this will lubricate it sufficiently for the next planing.

Why a Light Hammer is Used in Riveting By W. D. Graves

THE novice often wonders why a mechanic should I tap, tap, tap with a light hammer, in pounding down the end of a rivet, when it appears to him that one or two blows with a heavier hammer would give the same result in much less time. The fact is that



Effect of light and heavy blows

the heavy hammer would not at all effect the same result, as is shown by the accompanying photograph, which depicts two rivets, originally alike, both having been shortened to about the same extent by pounding on the ends. The one at the left was "upset" by a single blow of a heavy hammer, while the other was equally shortened by many blows of a lighter "rivet-

It will be noted that the heavy blow expanded the rivet quite uniformly for the whole length, while the lighter blows simply spread out the end of the other; the latter effect being the one desired in riveting. Of course, if the rivet had been rigidly held in a tight hole in solid material, even the heavy blow could have expanded only the projecting end; but rivets are not usually so held, and the tendency of the heavy blow, even in such case, would be to displace and apart the pieces which it is desired to bring firmly together.

This photograph graphically illustrates the fact that, though different blows may aggregate the same amount of force, their net result is not always the same; and that judgment and skill may find exercise in the use of so simple a tool as the hammer.

Shop Notes

Reducing Friction When Threading Brass.—When cutting threads on brass rods or pipes, the dies have a tendency to howl or squeal. Very strong soap suds applied to the brass will reduce the squealing as well

ding Small Tubing. -For bending small brass tubing, take a close spiral spring that will make a neat sliding fit in the tube. The spring is annealed at the part that is to be bent. Then out of g piece of hard wood make a form about which the tube is to be bent. To remove the spring after bending the tube, twist the spring in the direction in which it was wound. Tale will serve to close the spring so that it can be taken out seekly. This ill may be used on tubing up to \$1-inch dismets

Off for Oil Stones, —A splendid oil for oil stones is made by taking one part spars oil and one part kerosene mixed, or if desired two parts kerosess may he used.

Removing Rosin.—In soldering work with soft solder, using rosin for flux to give a nice appearance, the melted rosin may be removed with a cloth moist-

A Useful Device for Lettering Tracings By Ralph C. Davis

FROM the tell-tale pencil marks which are seen on tracings, and which often show on blue prints, it is evident that many draftsmen do not know of the simple method of producing guide lines for letering their drawings. The illustration herewith shows a method which I have used for some time. It consists simply of lines drawn on a piece of Bristol-board

1/2	Nut
*	
¾	Guide for lettering tracings

properly spaced for the size of the lettering to be made. Then instead of drawing pencil lines on the tracing cloth, as is usually done, this device is placed under the cloth, allowing the lines to show clearly through it. The lines then serve as a guide in let tering. I have found this device especially useful when working line drawings for reproduction, as by figuring out the proper sizes for 14, 2/3, %, and other reductions, one can always obtain the same uniform size of letter in his finished engraving.

Protecting the Threads of a Chuck

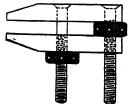
THE accompanying sketch shows how to keep the threads of a chuck clean. While the chuck is idle dirt will get into the threads, and if allowed to remain will cause the chuck to run out of true. Take



a piece of hard wood and thread it so that it will de the chuck. When the chuck is not in use the plug should be screwed in the chuck. This will keep the threads clean and there will be no trouble in getting the chuck to run true.

Handy Tool-makers' Clamp

THE drawing reproduced herewith shows a design of a tool-maker's clamp. It is frequently troublesome to get a clamp small enough for light work, such as small jigs, dies, etc. This clamp will take a



Handy tool-maker's class

variety of sizes, yet it is small and will not take up much room in the tool kit.

The clamp is made of machine steel and is adj by the means of two thumb nuts. There are six hold drilled in the nuts for the use of a pin lever with the jaws are to be clamped tightly on the work.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Storage of Compressed Acetylene

Even since illuminating gas came made to compress it into portable steel cylinders or flasks for use on vehicles, and for country residences. The results obtained, however, were unsatisfactory, for illuminating gas is generally a mixture of many different gases, some of which easily liquefy under pressure while others, like methane, hydrogen, etc., can be liquefied only at very low peratures temperatures. When these cylinders are connected up for use, the gas fed to the burner will vary greatly as to its heating and illuminating properties. properties. Then there is always a certain part, generally as much as ten per cent, that will not volatilize but remains as a tarry deposit in the cylinder. acetylene is admirably adapted for this purpose, for it is homogeneous in its comesition, leaves no deposit in the cylinder, and when properly fed to a suitable burner it gives an intense brilliant white light which is superior in many ways to any other form of illuminant.

The introduction of ac Hebting and other industrial purposes is of rather recent date Prior to 1895, this gas was scarcely known outside chemical laboratories, but the discovery of calcium carbide and the process of making it, made this gas available for commercial use. Acetylene belongs to class of unsaturated hydroca and is unstable except at moderate pres sures and temperatures Its critical temperature is 37 deg C., and pressure 68 atmospheres; however, it may be liquefied by a pressure of 21 53 atmospheres if the temperature is reduced to 0 degrees, and one cubic foot of this would produce 400 cubic feet of gaseous acetylene at atmospheric pressure. If acetylene could be safely com-pressed and stored in steel cylinders in this cheap and simple manner, its use to-day would be much more general than it is, but liquid acetylene at normal temperatures is about as touchy as fulminate of mercury, and its disruptive power equal to that of nitroglycerine. Early attempts to handle acetylene in this form were fraught with numerous violent explosions. Usually it was im possible to discover the primary cause of the explosion, for the witnesses rarely ever survived the disaster, but it is pro able that it was due to heat generated in manipulating the outlet valve or to some blow on the cylinder.

Acetylene under a pressure of less than two atmospheres or thirty pounds per square inch is practically safe against explosion. Should the gas be brought in contact with a wire at white heat or should a priming of fulminate of mer cury be exploded in the cylinder of gas at this pressure, the gas in immediate contact with the wire of fulminate will be decompo ed, but the explosion would not be transmitted to the whole mass. When under greater pressure, an ex-plosion caused by heat or concussion at one point, is instantly transmitted through the whole mass, causing a vio-lent explosion. If the gas is in the liquid form, the pressure generated is top filled with gas under a dangerous enormous amounting to 5,000 or 8,000 pressure. Under a pressure of ten

exploding, acetylene disintegrates

place lamp black for delicate work. It acctone alone was too dangerous to make | making black paint, printers' ink and for

At this pressure and at ordinary temperature the acetone will absorb about 300 times its own volume of the gas When the valve is opened the pressure is

Hess, discovered that acctone, a combustible liquid resembling wood acctonel, or charcoal, etc., and then added the would readily absorb actylens gas in putting this discovery in practical use, as before in this way he presented the processing and the confidence without as before and then putting this discovery in practical use, as before in this way he presented the section of the processing and the processing and the processing and the presented the section of the processing and the presented the section of the processing and the presented the section of the presented the presented the section of the presented the presented the section of the presented the p bestos entirely filling the cylinder This filler decreases the gas holding capacity about twenty per cent, but its addition reduced and the surplus gas passes off reduced the surplus gas passes off reduced to the point of use, such as a burner, plosion. In practice, these evilinders loaving the accione unaltered and cap charged under ten atmospheres will hold

The consumption of compressed ace has a pure black cast or tint, is free the process a commercial success tylene has become enormous in recent from grease, and is specially suited for A few years later, Edmund Fouche, of years Small portable generators are Paris, added the final element which not practicable in winter, as the water made compressed acctylene a commercial is apt to freeze, but the solution of acc possibility. He first placed in the eviintone and accetylene will not freeze during der a filler of some inert porous aubthe coldest weather. To-day no autoillustration is shown one form of filler but to a limited extent on locomotives now in use. It consists of disks of as for supplying the head lights, but this field may widen in future, for the light produced by acetylene comes nearer to being the same as sunlight than any other forms of artificial illuminant, and hence does not distort or alter the colors of the various signals used in railway

> and Fouché were patented in this coun ticable process so far developed for stor ing compressed acetylene, they have been bitterly fought, but so far they have been sustained (see 166 Fed R 207). The courts have also decided that the recharging of an exhausted cylinder was an infringement of the patents (see 181 Fed R 387) These patents still have a number of years to run and constitute a valuable monopoly



The use of a cylinder with porous packing for storing acetylene under pressure.

able of taking up a fresh charge of gas | about 100 volumes of the gas n In all cases where acctone is used, the at atmospheric pressure valve must be kept at the top to prevent its escape. No trouble, however, would result should it get mixed with the gas. since it itself is inflammable. The gas stored in this way is safe against ex-plosion so long as the cylinder is full, but this process is open to one serious objection. Acetone increases in volume objection. when it absorbs the gas. A cylinder having only forty-seven per cent of its volume filled with acctone at the begin-ning will be entirely filled with liquid when fully charged with the gas, and when the gas is escaping it shrinks, so that a cylinder which has been in use for some time will have a space at the atmospheres (150 pounds) the presence of the acetone is an element of safety,

wire passing through the cylinder and heated electrically to a white heat has no other effect than to decompose the gas in immediate contact with it, for the porous filler effectually prevents further spread of the explosive v the The prons filter alone, when composed of charcoal, forms a perfectly safe medium for the storage of the compressed gas if the pressure does not exceed seven atmospheres. At this pres sure, according to Capelle, a cylinder of one liter capacity will hold eight to nine liters of acetylene measured at atmos pheric pressure. This is a cheap method and may be used advantageously where a large reserve supply is not needed. When the cylinders are exhausted the are usually sent to some central charging station lilere acetylene from the

Resignation of Mr. Henry Blandy

HENRY BLANDY, one of the best known assistant examiners of the Patent Office, has just resigned. of il) health. Mr. Blandy was in the Pat-ent Office for a period of over forty years He entered the Patent Office during the administration of Commissioner and was promoted eventually to first assistant examiner. His resignation takes

officet on May 19th, 1911.

Mr Blandy is a man of much refinement and culture, was devoted to his work in the Patent Office, and will be very much missed both by the Patent Office and the profession

As an examiner in the class of musical instruments, of which he has had charge for many years, Mr. Blandy was pre-eminently "the right man in the right place" Gifted with a remarkable talent and love for music which were developed from earliest childhood, under the best instructors here and abroad, and possessed of retentive memory and great enthusiasm, he was useful in the treatment of the art during the great upbuilding of the past few years. At the time Mr. Blandy undertook the class of music, it was insignificant compared with what it is now. As time passed his long experience was added to his other qualifications so that for many years he has been doing what no other man could have done. Time after time, parts of the work were assigned to others, until practically his entire attention was given to the automatic self-playing instruments, to which he has devoted his attention for the last few years. Some idea of the growth of the musical class of inventions may be had from considering one of the 250 sub-classes of music, to wit, the keyboard players, pneumatic which at the time Mr. Blandy undertook the class contained in exploding, soctylene disintegrates of the acetone is an element of safety, [sq. station. Here acetylene from the Blandy undertook the class contained and hydrogen is set free and usually for the acetylene dissolved therein does takes fine as it comes in contact with not explode, but should the pressure be pressed generally in two stages, care that the carbon is thrown over twenty atmospheres (300 pounds) in the air, while the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown of the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmosphere (300 pounds) in the carbon atmosphere (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon is thrown over twenty atmospheres (300 pounds) in the carbon and the presence of the contain a portion of the carbon atmosphere (300 pounds) in during Mr. Blandy's long service, and others were so little known at its begin ning as to have been practically non existent at such time. Among these are the autoharp, the keyboard mechanical piano player, so widely advertised now, the telharmonium and several types of electrical planes which promise to endow the plane with practically the capacity of an organ for expression and sensitiveness of touch. Mr. Blandy has seen the successive great changes that have taken place during the last thirty years in response to the improved popular taste and the ability of the public to pay for better instruments.

tors have made immortal are still with us; but added to them are the pneumatic electrical organ and niano, an orchestrion and other equally wonderful instruments, while other still more magnificent ones Thus rewill doubtiess soon appear. Thus re-ferring to Mr. Blandy in connection with his work seems almost like a historical review of the art in which he has lived his life thus far He has grown with his work, has extended his acquaintance among the leading inventors of the art to which he has been devoted, and he will be greatly missed from his accustomed

The Congress of the International Union for the Protection of Industrial Property

THE appointment of delegates to th Congress of the International Union for the Protection of Industrial Property has been a slow process. The Commis sioner of Patents, who is the chairman of the United States delegation, has been preparing a list of foreign delegates, adding to it from time to time as the nations important nations who were adherents to the former treaties and conventions and who have not yet announced the names of their delegates are Germany, France, Austria-Hungary and Italy. The Italian government will not be represented at the Conference, owing to the fact that the International Expositions of Rome and Turin and the numerous congresses conferences which will take place in the Kingdom of Italy this year on the occa sion of the celebration of the fiftieth an niversary of national union, have ab sorbed the activity of many persons, who on account of their technical and scienti fic competence, are a necessary help to the Royal Government in the preliminary work necessary to prepare for its partici-pation in the Washington Conference. In addition to this reason, the Italian Royal Government, having presented to Parliament a project of law on industrial patents, a law which would radically modify on many points the law of 1859 now in force, could not begin internation al negotiations until the new regime in this matter is finally settled

At Washington, however, it is hoped that Italy will designate some person to be in attendance at the deliberations the Congress and represent that nation Austria, Germany and France will point delegations very shortly, it is exected, the last two nations having ready signified their acceptance of the in

Commissioner Moore is now engaged in the preparation of the programme for the Congress, which is based, of course, upon the propositions submitted by the various nations. Most of these have already been received through the International Bu reau at Berne, and M. Morel, the Director of the International Bureau, is now in Washington.

composed of Mr. A. Mitchell Innes, Counsellor of the British Embasay at Washington; Bir Alfred Bateman, K. C. M. G.,
late Comproller-General of the Commerof preparation and of Alexandra Management of preparation and of Alexandra Management of the Commerof preparation and of Alexandra Management of the Alexandra Management of the Alexandra Management of the Manag The delegation from Great Britain is late Comptroller-General of the Commer of preparation and of disposing of the cial, Labor and Statistical Departments many questions as they arise.

of the Board of Trade, and Mr. W. Te ple Franks, Comptroller-General of Patents, Designs and Trade Marks. Mr. In nes has represented his government at Stockholm and at Busnos Aires at similar conferences. The delegation will be accompanied by Colonel Herbert Hughes, C. M. G., Law Clerk of the Sheffield Cut lers' Company, as expert adviser, and by Mr. A. J. Martin, of the British Patent

Office, as secretary.

The delegation of Japan is co of Morio Nakamatsu, Director of the Im-perial Japanese Patent Office, and Mr. Keishiro Matsui, Counsellor of the Japan ese Embassy at Washington. From Bel gium will come a delegation composed of Octave Mayant, Chief of the Department of Industry; Georges de Ro, formerly at torney-at-law accredited to the Brussels Court of Appeals; Albert Capitane, attor nev-at-law accredited to the Liere Court of Appeals, and J. Brunet, Director-Gen-eral of the Department of Commerce and Consulates. Denmark will be represented by Count Moltke, Envoy Extraordinary and Minister Plenipotentiary at Washington; the Netherlands by F. W. J. G. Snijder van Wissenkerke, Doctor of Laws and Director of Industrial Property Bureau and Counsellor to the Ministry of Justice. Switzerland will send Dr. Paul Ritter, the Minister at Washington who will be assisted by W. Kraft, assistant in the Bureau Fédéral de la Propriété Intelectuelle at Berne.

The other nations, adherent to former conventions, who have not yet appointed delegates are Brazil, Cuba, Spain, Mexico Norway, Portugal, Sweden and the Pro-tectorate of Tunis. In addition to the adherent nations members of the Interna tional Union, thirty nations were invited to send delegates and so become enrolle among the members of the Union. Of these, a very small number declined the their announcements. Among the invitation, and those who have named tant nations who were adherents to Costa Rica, Groece, Hayti, Panama, Para guay, Persia, Russia, Siam, Salvador and Uruguay. Acceptances were received from Colombia, Ecuador, Guatemala, Hondu ras and Liberia, but no delegates have been named by these countries.

The Canadian delegation is com of Sydney Fisher, Minister of Agriculture, who is also Commissioner of Patents, and George F. O'Halloran, the Deputy Minister of Agriculture. Russia has named Mr. Gregory Willenkin, finan-cial attaché of the Embassy at Washington; Greece will send Lysmague Caftandjogiou, Costa Rica will be represented by Senor Calvo, the Minister at Washington and Panama will be represented by Mr. Bellsario Porras, recently appointed Min-ister at Washington. Clifford Walton, Consul General of Paraguay at Wash ington, will bear the credentials of that nation, and Edward H. Loftus, First Sec retary of the Legation at Washington, will represent Slam In the absence of the Persian Minister from Washington, the charge d'affaires, Mirza Ali Kuli Khan will represent the Shah at the Conference, and Dr. Alfredo de Castro, First Secretary and charge d'affaires, will be present on behalf of Uruguay. Salvador will send its Minister, Mr. Federico Mejia and Hayti has named John Hurst and Edgard Numa, Jr., as its delegates.

There has been no intimation as yet a to the personnel of the French, German and Austrian delegations, but it is likely that the representatives of these nations will be chosen from members of the Diple matic Corps now at the American capital M Morel, Director of the Bureau at Berne, will, upon his arrival at Washing ton, open a temporary headquarters for the transaction of the business of the Con ference, and render such assistance to the American delegation as his ripe experiLegal Notes

The Grant Rubber-tired Wheel Rubber Held to Be Vatid. The Eugenesis Court has recently (April 1866, 1871) decided the case of Diamend Euther Tire Co., vis. Consolidated Rubber Tire Co., budding the Grant patent No Ras 200 Grant patent No. 554,675 for a ret tired wheel not anticipated, valid, and in-fringed. The patent sued on was not a road one, the counsel saying of the specific construction of the Grant tire as it is actually shown and described in the

The decision is of importance in indiating the Court's position in a case where the novelty is limited to the specic construction. The invention was in a highly developed art and, not the least influencing factor, the respondent exactly imitated the patented device instead of attempting to evade it. As to novelty and utility, the Court said, "It was certainly not an exact repetition of the prior art. It attained an end not attained by anything in the prior art and has been accepted as the termination of the struggle for a completely successful tire."

As to the right to protection of the limited invention, the Court says, "In its narrow and humble form, it may not ex-cite our wonder as may the broader or pretentious form, but it has as firm a

ight to protection."

In treating the exact imitation of the atented device in view of the con that the prior art was crowded with numerous prototypes and predecessors of the Grant tire, the Court very aptly says: 'It gives the tribute of its praise to the prior art; it gives the Grant tire the trib ute of its imitation as others have done And yet the narrowness of the claim seemed to make legal evasion easy."

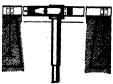
It appears that the apparent cope of the patent coupled with the ne essity of closely imitating the patented structure in order to secure the desired esult, actuated the Court of last reso in holding the patent valid and infringed

The Patent Monopoly Legally Consid-The recent decision by preme Court in the Dr. Miles Medicine Co. case may be regarded as bearing more or less on patented inventions be-cause it seeks to distinguish between control by virtue of patent grants and con-trol by way of contract in cases where the statutory monopoly is not involved. The question of control by the owner of a patent has of course been the subject of much litigation, and it arises directly and indirectly, the latter more frequently because of repairs to natented machines. An early case of patent control after pur chase is that of the bale tie in which a patent was granted covering the buck and band, and the tie as sold was marked "Licensed to use once only." The parties sued purchased the used bands buckles as scrap iron, straightened them out and connected them, in cases where they had been cut, and sold the ties to be used. The Court held this an infringement of the patent. On the other hand, there are cases which appear to lean to the view that where the device or machine o overed by the patent has by sale and purchase been taken out of the mo nopoly, the patentee is without right to restrict its use for his benefit, the machine becoming the property of the pur-chaser to be used or sold or disposed of as he pleases, so that he may repair it to any extent he pleases so long as the identity of the original machine is not destroyed. If, however, the machine is worn out or practically destroyed, the destroyed. If, however, the machine is worn out or practically destroyed, the country of the product of the pro

RECENTLY PATRICTS

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PROCESS FOR REMOVING INK OR COL PROCESS FOR HEMOVING INK OR ORING MATTER FROM PAPER.—V MELTILL, Sayre, Pa. This improvement talks to a process for removing lade, on matter or pigment from paper. Whe object is to provide an exceedingly a process for taking out ink from printed a such as old newspapers, book paper, etc., such as old newspapers, book paper, etc., when the provide and the paper of the paper of the late repulsed and made again to which the late repulsed and made again to which OIL-WELL CONTROL.—JANUS 28. SUITS and ROREZ B. ARMSTRONG, Douglas, Arks. Among the principal objects which the investion has in view are: To provide means for checking and controlling the flow of oil water or gas from a deep hored well, and to



provide an energency flow checking device to control the resk of liquid from the well der-roption to the resk of liquid from the well der-pries to the installation of the controlling level therefore. Other complexity and the level the resk of the controlling and confluence of the resk of the controlling the only when and as a guester is opened and when the same is a nextrained by the drive or spuri of the oil or water, as the case may be, to be pust the control rods and through the head of

bold Utilit

Flourable Berl Byriking... W Thourson, New York, N Y. The size of this isvention is the provision of a pring made in sections, capable of folding one on top of the other to permit convenient cleaning underneath the bod, and to take up very little room when control of the cont

Machines and Mechanical Bevice

AIRMITE—John W. Wansworm, Loctadele, Pa The invention illustrated by the engraving roless particularly to the beavier-than-air type of air ship. The object is to produce an air ship bilds will have a high degree of buoyancy and dirigibility. In its



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INQUIRY COLUMN

and Queries.

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The Wm. Cramp & Sons Ship Building

Company says:

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high standard as Keystone Grease.
Keystone Motor Oil is the only lubricant that will not deposit carbon under will not developed the second of the second of





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Heat from Dust

(Continued from page 444.)

no smoke in burting, and therefore large amounts of it are now being removed from the banks, where it has been stored for years, subjected to a washing process if necessary and shipped to the larger cities of New York State and New England, where it is sold as a fuel for heating office buildings and producing price imple laws. On the city is the largest user of this cult was the producing the control of the cult was control of the cult of the largest user of this cult makes excellent.

This anthracite culm makes excellent riquets and gas-producer fuel, as will be shown presently.

Coke Biceze. Coke breeze is a by-product of the coke or gas industries. In the preparation of illuminating gas, the coke resulting from the distillation of the coal when removed from retorts is in the form of large and small pieces and dust. This dust and smaller sizes are called coke breeze.

In the manufacture of coke, both by the bee hive oven and by-product methods, coke breeze is also obtained in

methods, coke breeze is also obtained in large quantifies. Methods of utilising it are described further on in this article. Sanduat and Wood Wastr. One of the most wastful of our industries is the wood industry. Mr. George B. Frank-forter states in a recent article on "Wood Waste and its Utilization" that the best Waste and its Utilization" that the best that model mills can do at the present time in the logging and milling part of the industry is to save a scant 40 per cent of the total weight of the wood in lumber, laths and shingles. Fifteen years ago the average was probably only 30 per cent. The average was probably only 30 per cent. The average, now, is about 35 per cent. The average, and a bout 35 per cent. The average is a considerable and a second part of the second cent lumber and 65 per cent waste. This waste includes stumps, tops, slabs, and sawdust. From 5 to 15 per cent of the logs sawed go into slabs. About 20 per cent of the logs sowed go into slabs. The most economical lumber mills in the country, at Marshfield, Oregon, saw on an average 100,000,000 feet of lumber on a top of lumber. On the basis of 65 per cent waste, this one mill alone produces an-nually 225,000 tons of wood waste, and this waste is burned either on the ground where the trees were cut or in waste where the trees were cut or in waste burning furnaces at the mill. If one mill, and that the most economical, produces annually 225,000 tons of waste, then the total loss for all the mills in this country must be enormous.

This wood waste can be utilized in several ways, some of which will be mentioned.

mentioned.

Lignite. Lignite is a variety of fuel between peat and bituminous coal in quality. One form of lignite is called brown coal in Germany from its characteristic color. In this country it is the custom to speak of two kinds of lignite, viz.: lignite and black lignite.

viz.; lignite and black lignite.
There are immense deposits of lignite coal in the western and southern States, the most important deposits being found in Texas. North Dakota, Colorado, Montana and California. These deposits vary in thickness from a few inches to over thirty feet. This frue contains a high percentage of water, American lig. nites having as high as \$4 per cent of mine. This high moisture content decreases the heat value of the fuel, and as recesses the heat value of the fuel, and as

* 10 To 12 QZ (1894.244.7) \$ \$229.0484 # \$299.4

The gas-producer to convert it into ommercial power.

2. The briquetting process to conver

2. The briquetting process to convert tinica domestic fael.

Gas.Producer. The gas-producer has been brought up to such a state of perfection that it is without doubt the most efficient means of obtaining power from the power grades of fuel. To those who are not familiar with the principles of the gas-producer! It may be well to explain that a gas-producer is an application of the fuel of the producer is an application of the fuel of the producer is an application of the fuel of the spatial that a gas-producer is an application of the fuel in the lower part of the apparatus forms action districts. of the apparatus forms carbon dioxide, and this is partially reduced to carbon monoxide in passing through the in-candescent fuel in the upper part of the bed. The steam is broken up into hydro-gen and oxygen. The hydrogen and car-

bon monoxide are combustible gases and car-diluted by nitrogen and some carbon dioxide they form producer-gas which has comparatively low heat value.

This producer gas when used in a gas engine produces power at a much greater efficiency than is obtained by the steam boiler and steam engine.

In those European countries where the supply of high grade fuel is limited, gassupply of high grade fuel is limited, gas-producers are extensively used as a means of generating gas for power pur-poses from lignite and waste fuel mat-terials in the interior of Mexico, where coal is scarce, mining companies use a scrub growth of wood for gaspro-ducer fuel with satisfactory results.

ducer fuel with satisfactory results.

As industries develop in those parts of the West and South where vast deposits of lignite are to be found, we may look for a rapid increase in the number of producergas plants using lignite fuel to supply the power-required, and as these parts of the country become more thickly populated by people endustrial pursuits, there will be a demand for lignite briquets for domestic fuel.

Bituminous slack. anthracite Bituminous siack, anteractic cum, wood waste, lignite and even peat, if the latter is partially dried, can be used with excellent efficiency in the gua-producer. Coke breese also gives good results as a gas-producer fuel. Lignite even in the gas-producer fuel Lignite even in the raw state furnishes an excellent producer-gas even better in heat value than the gas produced from the best grades of bituminous coal. This improvement is due in large measure to decomposition of the large amount of molsture found in the lignite into hydrogen and oxygon. Peat is a good gas-producer fuel if ar dried before use so that it contains less than 40 per cent of molsture.

Briguittid, Fuel. The process of

than 40 per cent of moisture.

Briquetted Fuct. The process of briquetting fuel, although not very well known in this coustry, is perhaps the best method of converting a low grade fuel into one of higher value and of utilizing the waste from milying high grade fuel. The briquetting process is a method of converting loose pulverlient. This briquetting receives the second of the process has been sent the process of the proce

moisture in them when fresh from the mine. This high moisture content decreases the hard value of the fuel, and as it is non-taking, special furnaces are required to hurn the raw lights properly Lignite cannot be stored in the open in large piles on account of the slackening indown that takes place when it is sposed to the worker for only a few weeks. Spontaneous combustion also occurs under the properly in the same years. Spontaneous combustion also occurs with the properly in the same years the United States with bituminous coal. In the same year the United States was the point of the point at \$323.670, or an average price of about \$3.50 per ton. In 1999 the plant of the point of the point of the point of the point of the produced 128,581 short recognized in the classifications of feels. In the same year the United States with the point of the point

and supplying heat to dry it is problibly success. When the public is once familiar with Numerous experiments in this country to utilize peat for fuel, here not not to utilize peat for fuel, here not not the much success up to the present it ins, there will be not difficulty with much success up to the present in selling all that can be made at a profit time, but possibly in a few years the of not less than one golder a text. If a text is a few success and profit is selling all that can be made at a profit time, but possibly success.



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ton may be realised, but of course this would be an exceptional case.

The general method of briquetting a feel is to mix the powdered material with from 5 to 11 per cent of pitch from course of the course of the

Briquetted fuel is now on sale in New Briquettee rue: is now on make in New York city and vicinity; Detroit, Michi-gan; Kansas City, Missouri; Indiana-olis, Indiana; St. Louis, Missouri; Su-perior, Wisconsin, and other cities.

perior. Wisconsin, and other cities. Coke brees, although of good fuel value, has been to a large extent wasted and many attempts have been made to briquet it. but up to the present time with small success, owing to the abrasive action of the breese which acts very many the continued of the breese which acts very many the continued however, and it is to be found on the continued, however, and it is to be hoped that ultimately this can be successfully done

done

Bituminous slack and anthracite culm
can be made into excellent briquets and
practically all of the fuel briquetting
plants of the country are at the present time using one of these two fuels.

Sawdust is briquetted by several firms

sawdust is priquetted by several nrms in Europe for a household fuel. Saw-dust briquets, while almost as easily ignited as wood, burn much more slowly owing to their having been compressed so highly in the making. This is an ad-vantage as the fire does not need replen-ishing so often

ishing so often
As stated above, some varieties of lignite can be briquetted without the addition of binding material. To do this,
however, a very high pressure is required Those lignities which require
binder to briquet them can nevertheless
be made into good briquets which will
stand the weather better than those made
without binder.

The property of the p

without binder.
In Germany, brown coal briquets have been used for the last thirty years as a household rule, and in the year 1908 15.700.000 short tons of these brown coal briquets were produced in that country. North Dakota is now carrying on investigations looking to the utilization of the lignite deposits within the borders of that State

tions or the steaming, briqueting, gas-producer, coking, and other qualities of the fuels of this country and the results of these valuable investigations have been published in bulletins of the United States Geological Survey and the Bureau been published in pulicins of the Office States Geological Survey and the Bureau of Mines. These bulletins may be ob-tained without charge by application to the director of the Bureau of Mines, Washington, D. C.

Manington, D. C.

Behavior of Iron in Concrete.—According to The Engineer, a reinforced concrete slab roof, built in Paris in 1852, in which was imbedded some small S4-inch I beams, has shown a perfect preservation of the Iron. Theriten years agovernation of the Iron. Theriten years agovernation of the Iron. Therete years agovernation of the Iron. Therete years agovernation. Recently a similar examination was made, which failed again to detect any deterioration.



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The Aeronautical Sectory Banquet.
The first annual banquet of the Aeronautical Society occurred at the Matel The first annual banquist of the Aero-nautical Society control at the Sisteld Astor, New York city, on the evening of April 37th. Although the society's senso-tian three years old and his marry 400 members, it has never held a pinique be-fore. The president of the society, Mr. Hudson Maxim, presided and made as elaborate speech in presenting to Wm. R. Heavet the Society's annual medal for the most landable act in furthering the cause of aviation.

The \$50,000 Transcontinental Aeroplane Priss.—Mr. Hears' responded and said he hoped his 850,000 priss for a transcentinental flight, which is up for competition until next October, would be the means of developing an aeroplane suitable for streme long distance cross-country work. As for the war aeroplane, he did not think this would have an extended use, oblicity hearters the country of this would have an extended use, chiefy-because there would be no wars. But for purposes of peace and commerce he believed the heavier-than-air machine would be widely used. He welcomed the interest now being taken in its develop-ment by our government, as he recog-nized that an aeroplane that would carry a cannon could just as well be used to carry a board of trade or a bale of merchandise.

Attitude of Our War Department
Toward Aviation.—Brigadier General
James Allen, chief of the Signal Corps,
told of what the War Department is try-James Alien, chief of the Signal Octys, told of what the War Department is trying to accompilab with its \$125,000 appropriation. He said the Signal Corps wants aeropianes capable of carrying a load of 400 penuds in access of the aviator, true-level, and of fight as after an Table 100 are seen to the second of could be called on in time of need, and he made it plain that the government ox-pects to help them in practical experi-mentation whenever possible. The theoretical side of sylation will be take in a laboratory at Washington.

Langley and His Part in Aviation.— or. Charles D. Wolcott, secretary of the Dr. Charles D. Wolcott, secretary of the Smithenoian Institution, spoke on "Gov-ernment interest in Aeronautics." After telling of Prof. Langley's experiments and his production of a steam driven model that few half a mile above the Potomae River in 1896, Dr. Wolcott ex-plained how our government came to the aid of his renowned predecessor and en-sabled him. On the contractions of the and of his resourced processor and en-abled him to build a man-carrying ma-chine. As is well known, this following-plane biplane was never successfully launched.

President Taft on Avistion.—The arrival of the Hon. William Howard Taft

told of the meteorological connection with aeronautics.

nt Street Las metallic filament lamps are but compete with are lamps for at metallic diament image; see beginning for compate with are image for stress light-ing in Europe. One point in their favor is that the first cost of the lamps in much less than for are lamps. One of the lamps German companies proposes a stress lighting system for Bartin, using 180 to 400 cardia-cover lamps their from their for-400 candle-power lamps hung from wire stretched across the street and spaced along about 180 feet apart.

Austria's Longest Electric Line.—The longest electric railroad in Austria is the 40-mile line running from Triest to Male, and it ranks among the long lines in and it ranks among the long lines in Europe. It was built especially as an electric road, and is narrow gaze, using overhead trolley and working on 850 volts direct current. The motor cars have four 50 horse-power motors, one on each sake. Current for the line is taken from the distant hydraulic stations of flarca on 30,000 volts, this being reduced in three subtainties along the railroad in order to feed the trolley wire. Freight and postal ours are also used.

postal cars are also used.

The High-sair Wiveless Station in Ge-many.—This will be the one which the Bawarian Government is to seet on the height of Zug, and will cover quite a wide radius. During the people right of instruments at this point it was found that signals could be taken from the time signals which this latter station is now sanding out. Owing to its slexue time signals which this latter station is now sending out. Owing to its elevated position it is intended to use the Eug post for meteorological work in connsc-tion with weather signals. The new plant will be erected this spring as soon as the weather permits.

as the weather permits.

A German Cable to Seath America.—
It is expected that the first cable from Germany to South America will be completed during the present year. The route is from Emden by way of Teneriffe and Monrovia; thence to Fernambuco. The new cable will serve the double purpose of connecting the German colonies in West Africa with the Latherland, and facilitating Germany's immensely important commercial relations with South portant of the South of the Cable Will yield a series of soundings over a tract of the South Atlantic that has hitherto been little explored.

Marine Cable Disturbed by Trolley Sys-tem.—Recently it was found that the op-eration of the syphon recorder of the sub-marine telegraph cable at Cape Town, South Africa, was interfered with by a South Africa, was interfered with by a trolley line. The shore end of the submarine cable for the length of a mile was at a mean distance of one-half a mile from the trolley line. As a remedy, a second or dummy cable, with an earth plate, was laid as nearly as possible over the old one, and this effectually cancelled the disturbances. Observations celled the disturbances. Observations made in London have shown that the earth's magnetic field is disturbed over the whole neighborhood of the City and South London Electric Railroad, and in the United States the utility of our mag-netic observatories has more than once been threatened by the trelley.

President Tafe on Avisaton.—The as, strivel of the Hon. William Roward Taft the United States the utility of our magnitude of the Commission of the United States the utility of our magnitude of the Commission of Acconsuite Invention.—The Hon. Edward B. Moore. Commissioner of Acconsuite Invention.—The Hon Edward B. Moore. Commissioner of Acconsuite Invention.—The Hon Edward B. Moore. Commissioner of Acconsuite Invention.—The Hold of the Roward B. Moore. Commissioner of Acconsuite Invention.—The told of the great Industry of Acconsuite Invention.—The told of the machine by which we navigate the air. He was followed by Rasz Admira in the State of whiten a substitute of the sub

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tion.

Mr. Lousing, who has come in interester contact with many of the most need street and with the street and content contact with many of the most need a profound study of the subject for years, is unusually well informed, and not a clear and definition sylv, and in a remarkation of the subject for years, in cultural many sylv, and in a remarkation of the subject of a various for the su

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PART IL AL President Type of

PART IIL and the Control Types XV.

1000 to 100 Page 270 Br \$2.50 mil, postpald hidael despite similar

Engineering

the Bitton Audinary are construcing, we understand, a 15-inch, 50-caliber gun If the present rate of increase continues, it will not be long before we are back to the 17-inch caliber, which was used in a few monster weapons of 20 years ago that were mounted in certain Italian resealting.

warships.

The Standpipe Shibboleth.—To place an elaborate standpipe system in a build ing is merely to begin the work of fire protection. To make it effective, fire drills should be practised regularly. The base should be unwound, valves opened, and water actually turned on Else, when the fire breaks out, valves will stick, and hose, rotted through by disues, will burst. Under such conditions, the finest stand-pipe system is nothing more than a delusion and a snare.

Thousand-foot Deck at London.—The first installment of the proposed improvements which are intended to place London, in respect of its equipment, on an equality with Liverpon, Southampton and other ports, is about to be commenced by the construction. other ports, is about to be commenced by the construction, at a coast of twelves million dollars, of the South Albert dock. The entrance lock will be 110 feet wide. 1,000 feet long, with a depth of water of 48 feet, and the works will include a new dry dock of the same length and width, with a depth of water of 38 feet

width, with a depth of water of 28 feet Desei Mariae Motors Save Money,—In a vessel of 5.400 tons now under construction, the use of Diesel motors adds 15,000 cubic feet to the hold space. At four voyages a year in the Black Sea trade, this means a profit of \$4,380. The saving in fuel would be \$2.877, and in wages, \$1,168. It is also stated that a Sahina boat of 100 tons equipped with of work in the herring flames morning of work in the herring flames of the performed by a steam-driven fishing boat of 164 tons.

boat of 164 tons

A 29-knot Dreadmought.—Time was
when the different types of naval vessels
were sharply distinguished by their posseasing in a marked degree certain individual characteristics of heavy gun fremassive armor, or high speed. To-day,
no such classification is nossible, as witness the laiest British battleship cruiser
'Indefatigable.' which carries eight 55
catilors, 12-inch guns, a belt of 8-inch
out trials of 24 hours' duration, is reported
to have steamed at times at a speed of
29 knots. 29 knots

An Experimental Mine.—The United States Bureau of Mines is carrying on a valuable test at Bluceton, about 12 miles southwest of Plitsburg, where an experisouthwest of ritsoling, where an experi-mental mine is being driven. Funds were provided by Congress for driving a straight entry from 2,500 to 3,000 feet plosions had previously occurred A par-allel entry, called an air course, will be connected with the main entry by cross cuts Entering the air course diag-onally is a "gallery entry," at whose outer end are explosion doors. Beyond them is a round steel gallery 120 feet long, in which coal-dust tests will be made.

in which coal-dust tests will be made.

Unusually Large Railrood Haset.—On the Lackawanna cut-off between Hopat-cong, New Jersey, and Slateford, Penn-ayivania, where some of the heaviest cut-ting and embankment in the history of valirad construction is being done, a huge blast was recently set off which dislodged 19,500 cubic yards of material. A tunnel measuring 4 by 5 feet was driven into the side of the hill and terminated in a cross tunnel of the same section, 91 feet in length. The :mount of explosives placed in the tunnel was section, 91 feet in length. The Limount of explosives placed in the tunnel was \$1,350 pounds of Judson R. R. P., and 12,060 pounds of 80 per cent Red Cross dynamits. All of the explosive was effective in breaking up and displacing

Science

Engineering
Progress at Panama.—The grand total of canal excavations to April 1, 1911, was laby.—As expedition led by Prof J Mandal States and States and

Penetrability of Matter.—It is held by more than one high authority that matter is neither continuous nor homogene-Thomson showed by an experiment ous Thomson showed by an experiment that hydrogen can be passed into a vacuum tube through an incundescent platinum window. In a similar way sodium passes through glass, and this is a useful fact in the manufacture of sommy peasage into the manufacture or vacuum tubes, because sodium can be passed into the tube to absorb the residual oxygen. Bellatt, the Italian physicist, has aboven that hydrogen can pass through cold from Matter may pass through cold from Matter may have the passed into Matter may have been passed to the passed by the

The Life of Mrs. Richards.—Miss Caro-line L Hunt, of 32 Ellot Street, Jamaica Plain, Mass, is collecting material for the life of Mrs. Robert H. Richards of the life of Mrs. Robert 11. Richards the Massachusetts Institute of Technology in order that the volume may be of such a character that it may not only a character t of such a character that it may not only interest those who have known Mrs. Richards either personally or through her work, but may also serve to extend her influence and to inapire future workers, any material, such as letters, photo-graphs, characteristic sayings and inci-dents, which will help to show her per-sonality and her far-reaching interests and activities, would be very valuable to Miss Hunt

Aerological Research in China.-Deutsche Zeitschrift für Luftschi Deutsche Zeitschrift fur Luftschiffahrt announces that an aerological expedition will shortly be sent from Germany to China. A base station is to be estabself universe that an accordance expectation of the control of the neronanta

Geocorolium,—This name is applied to a hypothetical gas, much lighter than hydrogen, which, according to Alfred Wegener, constitutes a layer of the earth's atmosphere lying above the assumed hydrogen atmosphere. It is analogous to, and possibly identical with, the "coronlium" of the solar corons. Weg. "coronium" of the solar corona. Weg. cure believes that the characteristic line in the spectrum of the aurora, heretofore usually attributed to krypton, is due to geocoronium According to his computation, published in the Physikolische Zeitschrift his gas forme only 0 00058 per cent of the atmosphere, by volume, at sea-level, but at an altitude of 500 Write for bookiet ktlometers (311 miles) it forms 93 per cent of the atmosphere, the remainder, at that level, consisting of hydrogen.

Stratification of the Atmosphera — Dr. Alfred Wegener continues his investigation of this subject, while has already led bim to some novel conclusions. In the Physicalasche Zeitzschrift of March 1st, he suggests that the presence of well-defined boundaries between atmospheric strata of decidedly different density. pheric strata of decidedly different densities (e.g., between the nitrogen and the hydrogen atmospheres) might account for the fact that in the case of certain explositons the sound was .mandible at about 30 kilometers from the source; beyond this distance occurred a "sone of subsections of the source in the sound was beyond this distance occurred a "sone of which the report count of behavior. This he or like the sound waves from the bounding subsections of the sound waves from the sound waves

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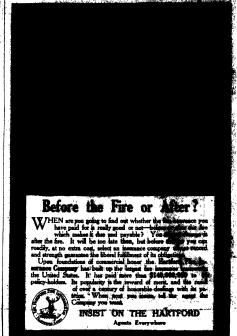
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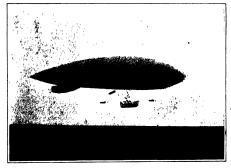
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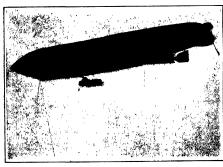
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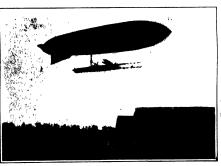
Car of the "Capitaine Marchal."



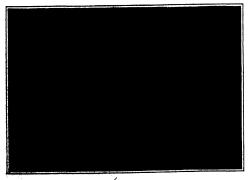
The new Austrian military airship, which is a modified Parseval.



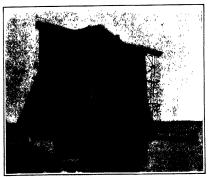
The French airship "Le Temps."



The French airship "Capitaine Marchal."



Pareeval hirship casting its shadow on Chemnits, Germany.



English airship shed to house the first naval dirigible.

And the second section of the section o

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, MAY 13, 1911

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The latter is always gird to receive for examination illustrated articles on subjects of timely interest. If the photographs are shorty, the actuals short, and the facts authorite, the contributions will receive special attention. Accepted articles will be paid for at require space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Aims and Accomplishments in Aeronautics

LTHOUGH the greater part of the present A issue of the Scientific American is devoted to aeronauties, so rapidly has the art developed that it is possible to deal in this number only

oped that it is possible to deal in this number only with some of its more important phases.

The world at large, and particularly the people of the United States, have heard too much about the disasters that have befallen the airship, and too little about its successes. The story of the operation of the dirigible, particularly in Germany, as told in the article on this type of air craft, will come as a great surprise to those of our readers to whom the term "dirigible" may have come to be synonymous with costly construction and dire disaster. The mailways of these very mishap proves that they were mous with costly construction and dire disaster. The analysis of these very mishaps proves that they were due, not to any inherent fallacies in theory or faults of construction, but rather to certain fortuitous conditions of wind and weather or the carelessness of

The charm of a well-written biography will always be enhanced by the introduction of the personal note. In the case of a man of the public reputation of the late Octave Chanute, it is not sufficient merely to recite the events of his life; wishes to be brought in contact with the man himself. This personal touch in the present biography of Chanute, which was written by one who for some years was a close personal friend, will render the notice particularly appropriate to the present issue.

The art of flying has not progressed so far but that there is still a wide field of fascinating inves-tigation before us. In the article dealing with the tigation is force us. In the article dealing with the always-tragic subject of a circiplane accelerate, the writer draws attention to a most important element in the question of stability, namely, that of giving to the acropiane sufficient flexibility to enable it to reld and adjust itself to the unevenly distributed shocks of a disturbed atmosphere. The French shocks of a disturbed atmosphere. In available a ground much attention to this most important question, and it should commend itself to thought of American aviators. Not only the serious thought of American aviators. Not only increased stability, but higher speed, will attend

increased standing out ingure specia, win account the solution of the problem.

There are few problems of the aeroplane or drightle that invite closer investigation or promise greater returns in efficiency, than that of the propeller. The field of acrial propulsion is fortunate in having at its disposal the valuable data obtained in naving at its disposal uter vanished and outsined in the investigation of marine propellers, and the study of the aeroplane propeller contained in this number, written by a naval constructor, will practice be of much practical assistance to builders of

was mevitable that the matter of automatic stability should, from the very first, have stood out as one of the most, if not the most vital connected with the art of flying. Automatic stability had been prolific of many inventions. Several of these have been selected for illustration in an article on this subject, in which their method of operation, efficiency, etc., are clearly and simply discussed. The conclusion of the writer is that we shall utilized. mately come to a type of machine which possesses an inherent stability, independent of movable wingendent of moveble wing-a conclusion with which tips and similar devicesheartily agree.

It is a common fallacy that the cost of one battle ship could be put into a feet of air craft whose military value would be vastly greater. As a matter of fact, as shown in the article on this subject.

of fact, as shown in the article on this subject, buttleahips will fight battleahips and air craft will be pitted against air craft. The 70-mile aerial scout may take the place of the 28-knot scout of the sea; but beyond that the aubstitution will not go.

By no means of the least interest to our aeronautical readers will be the article which reviews the very promising field of the so-called valveless internal-combustion motor. Of all the requirements of the aeroplane motor, that of reliability stands first; and there are indications that when the valveless type shall be brought to its final perfected form, it will carry the art a long step forward toward that ideal motor the advent of which the avistor is still eagerly awaiting. still eagerly awaiting.

A Centenary in Photography

HE centenary of the birth of John William Draper, which falls within the current month, furnishes a fitting occasion to cast a retro-spect over the development of the art and science of photography. For Draper was one of the earliest workers in the field, and in this country probably the first.

The history of any important invention is usually The history of any important invention is usually found to ascend for its origin to a very remote period. Perhaps the first recorded observation of a photo-chemical reaction is that of the "development" by sunlight of the ancient purple, as described by the Grecan princess, Fudoxia, Makrembossa, A. D. 990. The darkening of silver chloride to the control of the con bassa, A. D. Seb.. The darkening of suiver cuorace by light was discovered as early as 1556 by Fabricius, and was applied for a crude kind of copying process in 1727 by the German philologist J. H. Schulze. The first attempts at photographic portraiture were made in France, by J. A. C. Charles, trature were made in France, by J. A. C. Charles, who prepared simple shadow-photographs. Similar experiments were performed in 1802 by Thomas Wedgewood, who also tried, though without success, to obtain an impression, upon silver nitrate paper, of the image formed in a "camera." But the chief of the image formed in a "camera." But the chief credit in putting photography on a practical bisis must undoubtedly be given to Niepce and Daguerre, who joined forces in 1896 in perfecting the process of "heliography" invented in 1816 by Niepce. The final result was the famous dagnerrectype process, given to the world in 1889. Through Samuel F. B. Morse, information of the new process reached Prof. J. W. Draper of New York University, who in the year following obtained the first smilght portrait of a human face.

Since then developments have taken place rapidly and in all directions, so that to-day, not only are and in all directions, so that to-day, not only avoided out to great perfection, but the applications of photography in science and art have reached an importance which could hardly have been foreseen at portance which could hardly have been foreseen at the time of Daguerre and Prof. Draper. The process of ordinary photography has been so much simplified that the unskilled anateur has no diffi-culty in accurring pictures of any subject, whether are to rin motion. The perfection of the instan-taneous shutter has furnished Edison with the means for evolving from a crude toy, known as the xoc-trope, the modern kinetoscope, which not only affords entertainment and disseminates information among the people, but has served its function also in serio

scientific pursuits.

While the photographic plate is less sensitive than the eye as regards its response to a stimulus of short duration, it is nevertheless capable of reshort utraining, its interestications deplate to re-vealing to us objects whose light is too faint to affect our eye, for upon prolonged exposure the effect upon the photographic plate is cumulative. In this way stars have been photographed which the eye cannot directly observe. Spectro-photography has revealed to us the chemical constitution of the sun and other orbs, and steressespic photography enables us to see astronomical object would appear to some gigantic being, whose were a million miles apart.

If telescope and microscope have overcome some of the limitations of our senses as regards distances great and small, the X-rays have furnished us with great and small, the A-rays more turnisated an wrise the means of obtaining a view of objects hidden behind an opaque covering, and again the photo-graphic plate comes to our aid to record the struc-tures disclosed. And the latest development, the transmission of photographs by telegraphic mean-overcomes at once distance and debiasion distructions using vision. We are placed, as it ways, in acc-tion toomunication with eyes reaching out hundred of niles from our natural body, to which skey an linked by the nerve-transfe of an electric conducto. And thus another step forward is midel in the exten-sion of man's aphere of conscious perception.

The New Armar

OME thirty years ago, when the increasing power of rified guns had shown the need for armor plate of greeter resistance, the makerwere confronted with the necessity of providing a plate which was at once both hard and tough. Then plate which was at once both hard and tough. it was that the plan was tried of welding a face of hard steel upon a backing of softer metal possessing great toughness. Excellent in theory, the system hard steel upon a backing of sorter sures powers. great tonghoses. Excellent in theory, the system was found to be very defective in practice, chiefs because of the impossibility of providing a satisfactory weld between the two plates. At the proving grounds, the hard face would split up and break away from the backing. It was realised that in the state of the art, no satisfactory 'compound armor's as it was called, could be made. Then came Harvey's brilliant invention, in which the plate was made thousand the contract of the contract o homogeneous throughout its thickness, and the neces sary hardness imparted by carburisation of its from face. Krupp improved upon the Harvey process by using gas in place of solid carbonaceous material. The process of face hardening has always labored

The process of face hardening has always labored under the disadvantage that the super-carburination of the surface could be made to reach only a certain mited depth; whereas the continued improvement limited depth; whereas the continued improvement both in the energy of the projectile and its ability to hold together while penetrating the hard face, has enabled the gun to once more master the plate. To-day there is a demand for a plate having a much deeper layer of face hardening than is possible by present processes. During the past few weeks, much has been written in the European technical press about a new system of face hardening, known after the name of Simpson, the inventor, who appears to have adopted the Cammell process, but with the important difference that he has introduced with the important difference that he has introduced a plate whose weld is so perfect that under test, it presents no natural line of cleavage along the line of the weld. It is claimed that this result has been obtained by interposing a thin sheet of copper between the two plates before welding them together.

As in the case of many another important inven-tion, the author appears to have stumbled upon its secret by chance. In the course of some experi-ments, Simpson found that copper and steel, when subjected to a certain treatment, formed a molecular mixture or solid solution of the two metals. Later, he discovered that if two plates of steel with a sheet he discovered that if two plates of steel with a sheet of copper between them were placed in a mixture of carbon, brown sugar, and water of the consistency of compressed snow, and the whole mass were heated to 2000 degrees Fahrenheit, the copper meltred away into the steel and formed a weld so perfect that not only was it impossible to split the plate at the juncture, but the copper increased the transity of the steel. Professor J. O. Arnold, of the Universe of St. 6. of the steel. Processor J. O. Arnoid, of the University of Sheffield, after making a micrographic analysis of some specimens, stated that the copper seam formed a solution which was micrographically almost indistinguishable from the steel itself. The copper indistinguishable from the steel itself. The copper seam is so completely soluble in the steel that it takes a molecular form which is beyond the range of micro-scopic vision. The weld, in the ordinary acceptance of the term, has disannessed of the term, has disappeared, there being absolute ecular continuity.

Now, the importance of this process, in its bear-ing upon armor plate manufacture, is evident, since ing upon armor plate manufacture, is evident, since mow the thickness of the hard face may be increased to aily degree desired. It is stated that already trials have been made with 6-inch plates, in which two inches of soft backing, and that the plate, under attack by a 6-inch gun, gave very satisfactory results. If, as is claimed, the resistance of a given weight of armor has been raised from 20 to 22 per east, it follows: lows there is that additional percentage of a given weight of the present armor available to the designer, weight of the present armor available to the destigner, for improving the offensive or defensive qualities of a warship. He may increase the defensive qualities of his ship by retaining the present thickness of plate, or he may reduce the thickness of his armor and put the weight thus saved into a heavier battery or into more powerful engines, or into a larget cell supply. Probably, in view of the those powerful guns which are being mounted in the model's nasies, he will choose the first-named alternative—for it is certain that, at the present time, the sine assess to certain that, at the present time, the gun sen have the ship at its mercy. Carlot College Barre

Octave Chanute

His Work and Influence in Aeronautics

By Dr. Albert Francis Zahm

O'CTAYE CHANUER, who is sometimes called the "Pather of Aristion in America," did much to marit that titls. He and Langley were the deans of the ploneers of mechanical fight in this country. He promotes the sential congresses. He was the aymphetime of the proper of the sentific congresses. He was the aymphetime and prominent student of avaiton in the world up to the arrival of the first successful seroplanes. He made prominent student of avaiton in the world up to the arrival of the first successful seroplanes. He made and prominent students of avaiton in the world up to the arrival of the first successful seroplanes. He made and provided a figure of the direct and safe way to dynamic flight, by application of the gaschus earlies to the Chantuc glider.

Born in France in 1832, he came at the age of six

to New York, where he was educated, and at the age of seventeen began his lifework in civil ensering on the Hudson River Reliway. middle West, where he superin-tended the building of many railways, bridges and terminals, and finally, 1889, established himself in Chicago as civil engineer and president of a wood-preserving company. Though he became one of America's foremost engineers, he was from early manhood an en-thusiastic student of aviation, so much so that it required all his force of character to put aside those studies till he had first acquired a competence and some Finally about the begineigure. ning of the last decade of the nineteenth century, when Maxim, Langley, Lilienthal and Hargrave making their famous experi-Chanute ments in aviation, Mr harama cautiously from hie studies, and was quickly recog nized as the first authority in America, both in balloons and fly ing apparatus.

In 1890 the present writer, while a student of mechanical engineer ng at Cornell University, heard Mr Chanute lecture there on aero-nautics, and was introduced to him, then a silver haired gentleman of at, full of faith in th but apologetic enough for identifying himself with a pursuit so gen erally contemned. A few months later, Mr. Chanute accepted unfeigned trenidation the chairmanship of the Third International Conference of Aerial Naviration, to be held in Chicago ing the exposition of 1893, and immediately began, with character-istic energy and method, to have apers prepared on every topic of aeronautics and the allied sciences.

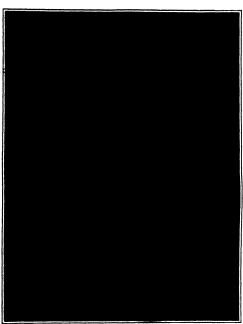
by the foremost writers and experimenters in that science throughout the world. Though he suffect not a little ralliery from his brother engineers for his interest in an "impossible" art, he pointed with some slation to the forty-five papers presented by the industrious members of this congress, the first of its kind held ig hardred. In 1884 he edited the proceedings of the conference, and at the same time published in book form his valuable series of articles in the American Engineer and Reiliony Journal, under the title of Progress in Plying Machines, a careful and discriminative work of more than one hundred thousand words devoted to the elementary principles of aviation, and to a critical history of all the most interesting and ingenious attempts to compass modulated in the control of t

This was really Mr. Chanute's graduating thesis in all flat was known in aviation at that time. He was now publicly and frevocably identified with acromatics; he was in constant correspondence and conference with numerous votaries of the science in mass; countries; his emple library was banked with sample library was banked with sample library was banked with sample discretization, and hung with souring birds and sample mass of the was a gentleman of

Control of the contro

means and of some leisure; he was definitely committed to aviation; he was proficient in the art; he therefore determined to embody some of his dreams in palpable form

In his opening address before the Conference on Aerial Navigation, Mr. Chanute expressed the belief that a dynamic filer could then be built, if men wished to risk their money without too much hope of a return. He even estimated that a one-man aeroplane could be made for twenty thousand ioliars. The two main difficulties seemed to him to be the securing of a suitable motor, and the manipulation of the machine in flight. Mr. Mosher, of New York, offered to build a steam engine of one horse-power weighing ten pounds, for ten thousand dollars, and a larger engine



OCTAVE CHANUTE

of like type for a larger sum. This seemed to answer fairly well for a first demonstration of the feasibility of mechanical flight, and accordingly Mr Chanute gave his attention, for the next few years, to the study of automatic stability, as well as the manual control, of

On June 22nd, 1898, accompanied by Mr A M Herring and two assistants, he went into camp among the eand dumes, on the southern shore of Lake Michigan, to study the art of navigating an eeroplane without artificial motive power. Mr. Chanute thought that the maintenance of equilibrium under all circumstances was at that time the most important problem of aviation, and that until automatic stability was secured, it would be premature and dangerous to apply a motor. Otto Lillenthal, in Germany, had made many successful down-hill gildeen on an eeroplane from which he was suspended by the arms; but Mr Chanute wished to evade, for he did not reliab, Lillenthal's way of balancing by shifting the body and kicking wildly at the stars. Ha main purpose, therefore, was to acquire the pilot's science; but secondarily he would learn much about the architecture of gilders, the behavior of air currents, the elements of propulsion and

He and his assistants made some flights with a

Lillenthal monoplane; but, finding this unante and treacherous, they discarded it in favor of a multiple wing gilder designed by Chante, which after many empirical modifications in the placement of the sussembled the Lillenthal biplane in having and an ordinary multiplane gilder of the present day. This gilder resembled the Lillenthal biplane in having the surfaces vertically superposed, the rider below them, and the rudder in the rear; but it was a five-device whose wings, on either side, could sworve fore and at, so as to bring the center of lift always over the center of gravity, in order to prevent excessive rearing or gravity, in order to prevent excessive rearing or gravity. In order to prevent excessive rearing or gravity, in order to prevent excessive rearing or gravity. In order to prevent excessive rearing or gravity, in order to prevent excessive rearing or gravity. In order to prevent excessive rearing or gravity, in order to prevent excessive rearing or gravity and the superior of the superior

the five-decker was displaced by a three-decker, which presently was deprived of its obstruire and unceaseful lower surface, thus assuming the familiar form of the Chantue biplane gilder. This was a radically new and elegant design, consisting of two superposed arched surfaces held together by vertical posts and diagonal wires, like a Fratt truss II was, in fact, the renowned "Chantus gilder" which has been copied by so many successful designers of biplanes

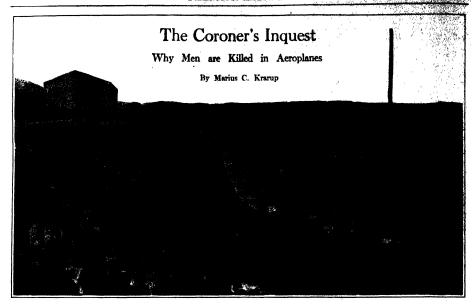
The Chanute glider weighed 23 pounds, spread 135 square for readily carried a total weight of 178 pounds at 23 miles an hour. It was provided with side planes and double rudder, and this latter was elastically connected with the main body to insure steadiness of flight, on the principle of the clasnight, on the principle of the clas-tic wing margins used by D. S. Brown in 1874 This craft was found easy to manipulate in launching, sailing and landing, a two-inch shift of the pilot's weight being equivalent to a five-inch shift on the Lillenthal monoplane Tt was steady at a speed of twenty to forty miles an hour through the air, even when the wind was blowing seventeen miles an hour overground The angle of descent was 75 degrees to 11 degrees, depending on the speed and trend of the wind. The work of gravity ex-pended in maintaining steady flight was at the rate of two horsepower for the 178 pounds, a good showing with the rider vertical.

Summer passed before Mr.
Chanute could perfect the Invention for automatic stability by
means of swerving wings; but
otherwise the gliding experiments
were very satisfactory. The strong
and simple biplane evolved during
those few weeks of fruitful study

was an important contribution to the science of aviation by reason of its strength and simplicity of design, its efficiency, its stability, and, best of all for that day, its record for good flights and safety. All who could appreciate it understood that the addition of a light motor would transform it to a dynamic flyer, navigable at least in mild weather

A full account of these experiments was published by Mr Chanute in the Aeronautical Annual of 1887, and in a paper read by him before the Western Society of Engineers in the same year. This paper stated that the experiments were promising, and invited other investigators to improve upon them. Presently other persons in several countries did improve upon them, notably the Wright brothers and Montgomery in America, the Voisin brothers, Ferber and others in Europe.

In March, 1900, one of Mr Chantie's earliest disciles, Wilbur Wright, wrote inquiring of him as to
the construction of his marchine, the best materials to
be used, the most suitable place to experiment, etc.,
saying that he had notions of his own that he wanted
to try, and that he knew of no befter way of spending his vacation. All that information was gladly
furnished, and the two men became fast frienda,
(Continued on page #8.)



N part a flying machine and in part a death trap, In the scroplane has done both more and less than its sudden arrival among the great inventions of the age had promised. The very assurance of a brilliant future for machines of its kind, which has been produced by its performances, renders it necessary that its defects be remedied and its failures obviated.

This combination of a Chinese or a box kite, an automobile motor, a restaurant fan, balloon rudders, junior bicycle wheels and ski runners, the strung together with plane wire and safeguarded with adhesive tape and mammoth rubber bands, sprang from toyland into the world of industry, politics, wa fare and finance when two plodding and practical tinkers of genius—self-made engineers from the American school of try, try and try again—proved they cruld balance and steer it by a twist of its muslin. Then, all could fly. Any kind of a kite, with any style of gasoline motor, with the fans pulling or pushing their blades of varying number, with rudders fore or aft or both, large or small, with keels, horizon-tal or vertical or both, or without any keels—just so the total weighed within limits—could be made to rise from the ground and travel on the wavering roads of the atmosphere. Even the twist of the planes could be counterfeited. Flight with the "heavier-thanair machine" was an accomplished fact. All minds turned to flight, to exploit or to improve the aero plane, or merely to wonder at its possibilities. In three short years, by improvements in its component parts and the training of many aviators, but without the addition of a single new fundamental idea to supplement or correct its original design, it has been developed to the point of carrying a considerable loa of tuel, lubricating oil and humanity for eight con secutive hours, while coursing over a distance of 350 miles without once seeking the mother earth. It has miles without once seeking the mother earth. It has fanned itself and its burden-going up at an easy incline, as the crane files when rising from the marsh—up into the thin air two miles above its starting point, where the aviator gasps for breath and the throat of the carburetor chokes with ice, and has slid down again on the spiral bannister which its own twisted planes shaped in the atmosphere. It has sailed over arms of the sea and over the gruesome glaciers of the Alps It has transported passengers from the capital of one empire to the capital of another, and back again it has circled over fortifica-tions and battleships and has brought home photo-graphs of the panoramas which spread beneath its course. While flying with it, men have sent and recourse. While nying with it, men have sent and re-ceived either messages. It alights on water or on shipboard and files thence home again Four, five and six persons, and re-cently even twelve, have clung to its sprays while the fan blow the whole ton-weight

from town to village, an ordinary half-day's journey. But between-times it has exacted sacrificial offerings to the demons of the atmosphere. Without hint or warning it has often suddenly refused to heed rudders and has dropped as a shot bird, anywhich side foremost. Hundreds who trusted the plan of its designers and their own skill have fallen back to earth, as all know, to lie on a couch of pain for months and rise finally with all fine frenzy for flying crunched out of their bones. Monuments have been erected over the graves of twoscore of young men who had thought the air was conquered, and that it was only for them, lucky Aladdin boys, to gather laurels and rewards for demonstrating the victory.

Now, the world turns a searching glance upon this machine which does so much and fails so treacher-What explanation is offered by the authors of the construction in its various forms, the Wrights, Biériot, Henry Farman, Curtiss, Levavasseur, Esnault-Pelterie and Louis Bréguet? What do they say, not with their lips, but through those actions which fater-pret thoughts the tongue scarcely knows? Though all brave and brainy, they all fly, now, just as rarely as compatible with leadership in progress. No other invention designed for sport and transportation work, and launched as complete and full-fiedged, was ever so readily turned over for others to enjoy. None was ever so sparingly used by those who knew it best.

What does the engineer say, the man whose pro-fession it is to compare the creations of inventive genius with the data of applied science to take note of their imperfections and to contribute to their ra-tional development? What structural peculiarities does he find which aeroplanes have in common an in which he detects violations of established engineering rules, whose validity no invention can change? If deaths are due to plain and indisputable engineering errors which might be avoided, the engineer should be a good man to have on the coroner's jury, when public opinion or sentiment chooses to impanel itself in that capacity. Limiting bimself to facts which are not disputed and to conclusions whose correct derivation from the facts all may check without special technical knowledge, the engineer finds about as

servation of equilibrium in a disturbed atmosphere depends upon control action by the aviator. The means for control are (1) twisting of the main planes or wings, and (2) operation of horizontal and Both the twist and the rudder action are required. One supplements the other in most for stances. Both must be reliable, if equilibrium shall be preserved under all circumstances. Even if twisting of the planes (or the almost equivalent manipula-tion of allerous or wing-tips) is assumed to constitute a reliable method for obtaining certain indis effects, the fact that this method is not sufficient for all purposes makes it certain that the preservation of equilibrium still depends ultimately upon the reliability of rudder action also. The facts relating to rudder action must be examined.

The efficiency of rudder action depends, oth

equal, upon the speed of the structure to which the rudder is attached. A drifting ship or a drifting balloon does not obey a rudder. The movement of the structure must be in the direction of its axis. Any deviation from this direction changes the neutral position of the rudder, and for this change the tor must immediately make allowance as best he can, It also affects the resistance against the progress of the structure, changing it from one equally divided on both sides of the axis to one unequally divided, and the rudder action is frequently not powerful enough to compensate for this inequality. In the case of an aeropiane, neither the speed of the structure nor its direction is assured. True, it makes no differ-ence that the whole machine may be carried sideways in relation to things on earth. Generally, only the relations to the surrounding atmosphere are of consquence, in so far as the obtaining of certain effects from certain control movements is concerned. But, sooner or later, an atmosphere current or eddy strikes with more than usual force one of the wings or one side of the planes, while other portions remain, for a moment at least, subjects to different influences. a moment at least, subjects to different influences. Birds, by their small dimensions, practically escape this difficulty. Then, if the disturbed posttlen given the whole machine is one so much inclined that the planes or winds tall to give their usual support, gravitation and the new lateral tilt of the planes enter as new factors in the play of forces and pull the machine away, in higher or leaser degree, from that axial direction of its movement which is ordi-narily maintained by the propulsive power. The rudders no longer act as intended. Position contri lost at a moment when most needed, although skill in allowing for the misalignment and suitable to of the panes (or turning of afterons) may obviate catastrophe when the disturbance is not too severe. The much smaller difficulties experienced in steering The univel smaller difficulties experienced in steerings a ferryboat when its bow is no one curvain of water and its storn in another filtratrate a parallel her less complicated and serious streaten. We're boute in danger of going to the bottom of the organ, every time they fail to obey the halmsman, raddiscounter would have to be abundoned for them, too. The obvious fact that either wing, being of small larger area than a radder, justify easily become settled to force in the atmospher's of much greater magnitude than any which the speed of the machine and

tude than any which the speed of the machine

The state of the s

irring to some on the simil resider area, is in Itself entitlement, to compal the same conclusion; namely, that control by redown is surreliable in any but a religible of the stroophers, and that the adoption of rudder action for control is mainly responsible for

the death-list of aviation.

The summers of control which may be exercised by the yielding of the main planes or wings is not eablect to the same objections, as it is effected through a readjustment of the same large surfaces which are astaclated, and not by attempting to influence the course of large distincted surfaces by counter-movements of much smaller sees. But this adjustment by twiet is meristing ascropianes of small scope and of insufficient variety, always coupling increased resistance clerk variety, always coupling increased resistance with increased if the one side of the machine and with reduced resistance and reduced lift on the other. Intributedly, however, the possibility is presented that the education of a slight twist of their surfaces, may be developed by inventive talent into larger and more varied control movements, causing more pronounced changes in the shape and position of either side of the planes and effectually counteracting severe disturbances of the equilibrium.

The engineer notes, further, that propellers of seripianes, though they receive all the motor power, deliver only a small percentage of it in form of propulsion. He knows that this so, without resorting to tests or calculations. A simple observation tells him. Aeroplanes of 40 horse-power or more can notoriously make no headway against a steady wind blowing at the rate of 50 miles per hour, but an automobile with limousine body can be driven against the same wind by the application, at the "irms of the driving wheels, of not move than 6 horse-power. And the sir resistance against a limousine is, according to the best tables—areas and their angles of incidence being considered—comparable to the resistance which an seroplane of ordinary size must overcome, at simlar speed. Calculations beaded on the draw-lar pull of aeroplane propellers also indicate a poor utilisation of the motor power.

It has been aeroplane practice to seek stronger pro

 pulsion by striving for higher motor power, but, acrules for good engineering, it is the efficlency of the propellers which by all means should be increased, since excessive waste in the mechanical transmission of power cannot be conceived as permasently acceptable. On the other hand, the fact that flight is possible with so much of the power thrown to the winds, literally speaking, seems to shed a strong light on the brilliant results which may be ed from aeroplane construction, when this enor mous waste shall have been gradually removed. At the present moment, even a slight improvement in the efficiency of propulsion would mean greater safety, as it would increase the effect of every control action, while, on the other hand, increased motor power means either increased weight or increased liability to motor troubles. Propellers of the present style also reduce safety by hindering speed when not revolving, as when the machine is gliding to earth with the motor stopped.

What becomes of the power of the aeroplane motor? It seems that the waste must take the form of heat imparted to the air by friction with the propeller blades and dissipated in the atmosphere

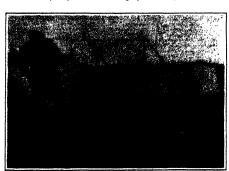
One more vital fact is observed. No provision is made in the majority of ecopians for tempering the jolis received from guets of wind or eddies. While it is highly least, the fact that its irregular movements are frequently so violent as to turn an exception of the completely over, exactly as a hole or a boulder in one side of the road may upset a rapidly-moving vehicle, shows conclusively that the natural elasticity of the disturbing element itself is fausificant under the circumstances, the resistance of the machine against any force tending to upset it being very small. As the "boulders of the sir" cannot be circumvented, being invisible to the aviator and also lable to overtake him, a spring supension for zero-planes, to 'protect against "road shocks," as vehicle applies protect automobiles, seems to the careful engineer even more strictly necessary than similar provisions are acknowledged to be for vehicles moving over soild roads. In point of fact, provisions of this nature, in the form of classite wings, are incorporated

in some aeroplanes, notably the Bráguet, the new Paulhan machine and the latest Esnault-Petterle, and these are yet to be heard from in accidents, though no engineer would expect to be able to proportion the spring elements correctly without considerable experimenting.

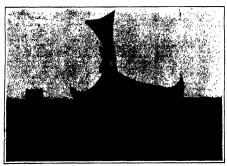
The consulted engineer of the coroner's jury has finished his remarks. The members smile a little, and one says to another "Well, rudders are not much good, it seems, for any machine that you can fall down from and break your bones, but, so far, they have not been able to find anything hetter, as what are we soing to do about it? We cannot stop progress. Suppose we recommend that invontors work a little harder and invite intuitors to retire from their perniclous activity. Will that do? Agreed? All right. Verdiet. "Nobody guilty, but aviators should not fly when the wind blows, until inventors have found some way of getting away from rudders."

The New British Meteorological Office

THE British Meteorological Office, which for more than forty years had been installed in cramped and unattractive quarters in Victoria Street, London, has recently moved into a new building especially designed for it in Exhibition Road, South Kensington transfer of the staff was completed November 15th, 1910, and on December 1st the Meteorological Committee, the governing body of the institution, held an "at home" in the new premises. The building is shared with the South Kensington Post Office, which, in accordance with the English custom, is also a telegraph office, so that the meleorological service now has all the facilities under its own roof for receiving and dispatching promptly its telegraphic reports, mailing its daily weather maps, etc A noteworthy feature of the new installation is a permanent exhibit illustrating the work of the office and meteorological work in general, a feature that the director, Dr. Shaw, hopes will have the effect of stimulating the interest of the public in meteorology, and lead to the recognition of the importance of including this subtect in school curricula.



Propellers make poor plowshares.



There is too often death in "the dive."



Shek nomercults mean broken wings.

THE WAXEN WINGS OF THE MODERN IKARUS

The Dirigible or To-day

A Review of French, English, and German Airships

By Carl Dienstbach

Tille unfortunate mishaps of large dirigible ballooss in recent years, among them Count Zeppelin's levistant, the French dirigible "Patrie" and
"République" and the German airship "Erbaloch,"
have aroused an unfortunate prajudice against the
lighter-than-air craft. Accidents, however, are as unavoidable in the experimental development of the airship as of the aeroplane. At the end of 1910, about
1,300 aeroplanes had been tested in France alone, with
the familiar frequent results. Because the crew of
an airship is more numerous than that of an aeroplane, the destruction of life, when it does occur, is
necessarily more appalling. For all that the total loss
of life which has resulted from aeroplane accidents
for exceeds the number of casualties that may be laid
to the door of the dirigible.

The Remarkable "L. P. VI."

In Germany at least the dirightle seems to have been brought to a pitch of perfection hardly realized in this country. The "T. P. VI.," built on the non-rigid Parseval system, was in practically continuous service for over alx months before it met with an accident. Hardly less advanced are the rigid Zoppelins. Military semi-rigids in Germany now make almost daily trips.

Probably the Parsevals are the most highly developed airships of the day, because they have been directly evolved from the old spherical balloon. The crack ship of the Parseval fortills is the "L.P. VI." That vessel has the same dimensions as the passenger carrying "Pall", which ascended aimset daily at the Frankfort Exposition of 1909. The car has been lengthened so as to provide an increased amount of structural stiffening for the gas bag and more commodious quarters for the passengers. The "non-rigid" propellers have been slightly stiffened and are now "semi-rigid".

Leaving Munich at 19-30 A. M on October 10th last, the "L. P VI." landed at Plauen at 4-30 P M., and read to the property of t

The only dirigible which can be compared in regularity of service with the Parsevals are the semirigid military Basonachs. Their records, however, are not as yet quite so free from accidents.

Some of the Leading European Types.

The huge French ships "Clement-Bayard II" and the "Morning Post" were built largely as a result of popular English opinion The "Morning Post" has a capacity of fully 363,000 cubic feet, and was at the time the largest ship that was ever constructed, with the exception of the rigid Zoppelins

the exception of the rigid Zeppelins
The German non-rigid "Krell I." a giant constructed
by the Slemens-Schuckert works, of 460,160 cuble feet
capacity, has outdone the "Morning Post." The craft
was avowedly built for military use only intermediate between the "Morning Post." and the "Krell
I." will be the newest Italian military dirigible, with
displacement of 282,560 cuble feet. Other remarkable craft are the "Capitaine Marchal" (named after
the "République's" unfortunate commander), which
displaces 254,964 cuble feet, nearly three times that of
the "République." The experiences of military service evidently made large size desirable.

As a general rule, the French have paid more attention to the construction of siralips than to the art of handling them. During last year's military maneuers, some of their dirigibles had narrow escapes. M Capazza, one of the most experienced of French air capitains, piloted the "Morning Post" on

her memorable trip to England across the widest part of the English Channel. He has publicly expressed admiration and envy of German airmanship. With the exception of the small "Zodiacs," the French military airships are rarely used to the extent that one would expect.

In England airships have been developed by the army on a smill scale. As a see power. England is naturally concerned with the development of the airship as an auxiliary arm to the navy. Big though they were from the very outset, the Zoppelins have grown from 55,160 to 708,400 cubic feet capacity. The British naval dirigible begins at the latter fagure.

The latest passenger sirabip built for Beiglum by the French Atra. Company, the "Wille de Bruzelles," displaces about 283,560 cubic feet. The most advanced experimental types, the German "Krell I."," and the British "N.I." were designed primently for military purposes. Although the French, who resilly lavented the motor-driven dirigible, have not developed lighter-than-sit craft as systematically as the Germans, they are produced ships which prove that the designers of the "Republique" have progressed with the times of the "Republique" have progressed with the times more approximation of the state of the stat

It is hardly necessary to discuss the comparative merits of the so-called non-rigid, semi-rigid and rigid systems. The very largest sizes will always be rigid. For the smaller sizes, every system has its own advantages and disadvantages. England and France now have rigid ships as well as Germany.

A most interesting construction is that embodied in the "Ville de Bruzellea." He lates Atar type. The single large front propeller of the classical "La France" is still retained; but the "Oldsment-Bayard II is" two elevated side propellers, somewhat reduced in size, and driven by a second motor, have been taken over from the "Clément-Bayard It." The result is that the ship remains under control even after the front propeller is stopped in landing. In the "Ville de Bruzelles" the Parseval shape of hull will also be found, characterized by a blunt, ovoid bow.

The Elaborate Equipment of the Big Airship.

The increased size of present strahips has already tended to greater refinement of detail. Donkey ongines are becoming common. Brucker's trans-Atlantic "trade-wind ablp", the "Succhard" is thus equipped, and so is the "Krell I." The gas bags of both ried and non-rigid dirigibles are subdivided latic compariments, like a ablp, the construction having been first introduced in the rigid Zeppelins. Multiple ballonets are also being adopted in greater number. Thus we find that the English Zeppelin ("N-I") has adopted the propeller mounting of the "Krell I.," the doject being to save long transmissions. In abape it also approaches the non-rylindrical ship. The Zeppelin form, however, still remains sessentially cylinderical ship.

The larger the ship the more elaborate may be the equipment. Wireless telegraph apparatus is now carried by the Zeppelin passenger ships as well as by military craft, so that the navigator may communicate with meteorological stations and keep himself informed as to the weather. Some extremely valueble experiments have been made by the Zeppelin Company in the effort to safeguard their craft from atmospheric electricity.

Preventing Accidents.

Indeed, the Zeppelin Company sees to it that it is impossible for the same accident to occur twice. Thus, the new "Deutschland" has an increased dynamical lift, an improvement that var a mode immediately after the disaster to the old "Deutschland." As a result, the new "Deutschland" case to a height of 3,800 feet with contrast the same that the same that the contrast of the contr

have the same unbroken lines below as above, to insure speed. Even semi-rigids and non-rigids could built more or less after the plan of the Spiess. The use of cars, in other words, the concentration of the load at a few points, is justified in smaller disrightes, because motors are used in heavy units to insure reliability.

Weather reports are now so important to the airship capital that the German government is beginning to take a lively interest in aeronautic metacorology. The Frankfort harbor has its own aerological observatory, situated in the Tannus Mountains. The government wather service has recently provided many of its stations with the necessary apparatus for measuring the strength and direction of the wind at various heights.

Handling a Dirigible in the Air.

The long period of apprenticeship required in the construction and piloting of a dirigible, a period which is longer, strange as it may seem, than in the case of an aeroplane, accounts for the slow development of the types with which we are familiar.

Although the army experiments almost daily in the air, the tactical handling of dirigibles is still shrouded in mystery No doubt there are definite rules to be followed, but what they are we can only guess. In the army, night trips are frequent. The airships are formed into squadrons and their pilots taught to maneuver in various formations.

In the popular mind, an airship is a kind of serial steamer, simply because it is propelled by engines. In truth, it is more like a sailing vessel in its inability to cope with unusual winds. Fifty years ago, when cooper's sea tales were the "best sellers" of the day, and the reading public was consequently more familiar with navigation than it is now, the principles of the dirigible would have been better understood than they are at present. Indeed, the true story of the "Deutschlands" disaster of last year equals in ormantic interest the most facinating pages of "The Flot" or "The Red Rover." It must have been a tense moment when the great airship was bed motion-less against the storm by the full power of her motors, her commander fearing to turn her nose toward safety, because of a black and yellowish bank of clouds afety, because of a black and yellowish bank of clouds that loomed up in that direction. His anxiety can be imagined when the gazes of his fuel tanks showed how rapidly his supply of gazoline was falliped.

Court Zeppelin himself pointed out that, dependent though it is on which and weather, there are times when the airship may outspeed the fastost express train between two clies. He admitted that for the return trip he might prefer the railroad to the airship, to avoid a head-on wind. Some day we may hope to see giant airships plowing tielt way through the air with as much indifference to wind and weather as a modern "Lustiania." When that time comes, there can be no doubt that the airship will be aiway preferred to the dusty railroad car.

To guide a craft through atmospheric disturbances of more or least violence roquires exceptional skill. Major von Parsevah has said of the competent air capain: "He must know exactly the speed of his ship and of its manouvering ability. Above all, he must have a nice sense of her responsiveness to her vertical steering apparatus, and be able to estimate her carrying capacity with considerable accuracy." On the trips from Munich, the "L. P. VI." covered attogether over three thousand miles. One trip to the Eugspitze material states from all three-quarters hours. On one occasion the Crowq Prince of Bavaria and Count Espaini mover passengers." With frequent small injections of fresh hadrogen, the "L. P. VI." bad remained instand and ready for service for fully twelve weeks. Although the gupmen tests of very stormy weather at Berlin upon its arrival there. In a gale of a miles an hour, a speed threafty exceeded by the vessel at her best, the Prince and Princess of Sachessia. Malchingth were taken up. Selling, the captain, made considerable headway by tacking into built, keeping the "Marbor" will to leavand, ready to return and land at a moment's notion. This was "airmaneably" comparable to the seameaship of any of Googer's harces. On these occasions, Capt, Brilling the output of the vertical steering gent, while his first editors, TLP, VI. had all its gas sensewed at the revolving wharf of the big Stemens-Schackert atraity at Die-

The second of the second secon

e on short trips, in addition to the crew. asion the passengers numbered seventeen, the with man being a stowaway who had hidden under a fuel tank in order to enjoy the experience of cruising sh the air. These trips were practice journeys h praceded the great flight to Kiel two days later.

which presents the great night to his two days like.

The maritime provinces of Germany have latterly
taken as lively an interest in the airship as in the
stampshy. They have founded a well-organized socity which has reised enough money to make Kiel a erent airchip harbor as well as a haven for steamers This society chartered the "L. P. VI." The journey to Kiel hegan under unfavorable conditions, for a gusty wind delayed the vessel. Six passengers booked places at Berlin; four more boarded the ship at Schwerin nd heavy rain made a landing necessary at Bordesholm, near Kiel, but only after it was impossi-Borceanoim, near Aisi, out only after it was impossi-ble to see. After the craft arrived safely at Kiel, Stelling received a telegraphic congratulation from the Kaiser. Schleswig, Flensburg, Hamburg, Luc-beck, and other towns were visited by the "L. P. VI." during its stay of six weeks at Kiel.

Advertising in the Air.

On her return to Berlin, the "L. P. VI." resumed her passenger trips. On every fair night the vessel has made a trip from Johannisthal to the principal thoroughfares of Berlin. A large square piece of can-yas was spread out on each side; outriggers 32½ feet long were equipped with projectors at their extremi-ties; the outlines of the car are traced in incandescent electric lights. The projecting apparatus flashes on the canvas, in letters legible for a distance of half a mile, such legends as "Schulz's Dog Pood is the Best," "Blix Pills for the Liver," and "Drink Ulmer Beer." Thirty different firms advertise their wares in this ultra-modern way, with the result that the air-ship earns about \$700 a night, in addition to the passenger fare.

A slight accident, occasioned by the immine of the ges bag against the airship's shed during a wind (the men, exhausted from overwork in handling the airship, could not hold her), later made it necessary to re-inflate the envelope. The gas, however, needed replenishing, for the airship had not been inflated for

Such is the popular interest in dirigibles that the "sporting" abips of the Parseval class (the "1. P. 1X.," of 52,980 cubic feet capacity and 64 horse-power, and the "L. P. V.," of 39,384 cubic feet capacity and 40 horse-power) had all they could do to satisfy the demands made upon them.

Airship Harbors.

Not only has each new military ship been larger than its predecessor, but the new military air harbors at Koenigsberg and Thorn (fortresses on the eastern frontier) have been constructed to house ships onehalf as large again as the biggest vessel now in ser vice. For craft so huge, portable sheds are out of the question. Permanent air harbors must be constructed, which will serve as bases for craft having a large radius of action. These bases, naturally built in fortresses, must be sufficiently numerous and well distributed to meet the emergencies of war constituted, they form part, as it were, of the active field force and become factors to be reckened with during hostilities. With the experience of the German airship division in night flying, it would not be difficult for a dirigible to enter or leave a fortress in the dark in safety.

The new Zeppelin harbors are planned on an elab-orate scale. To the stations at Duesseldorf and Baden-Baden, others will be added before the summer is over, at Potsdam, near Berlin, Frankfort and Hamburg. Money will be freely spent on these harbors special companies and municipalities. or special companies and miniminatives, because the harbors mentioned, the stations at Gotha and Klei will also be available, and in emergencies, the great military harbors at Cologne, Strasburg, Metz, Koenigsberg, Thorn Smaller cities that cannot afford great harbors with sheds are beginning to establish landing places and moorings Aerial beacons will soon be common, if we may judge by the experiments made at Spandau and Munich.

At present dirigibles are docked and started on their journeys by forces of trained men long practice has enabled these men to handle even such huge craft as the "Krell I" and the new "Deutschland," of Zeppelin, with ease Lack of practice or caution, on Zeppelin, with ease Lack of practice or caution, on the other hand, may result in accidents, such as that, for example, sustained by Zeppelin's new "Deutsch-land" at Duesseldorf, and by the "L P VI" To cut down the expense which the maintenance of a large body of men necessarily entails, we find that the



Detail view of the rotatable shed of the "Krell I."



Central car of the "Krell I."



The new Parseval VI.

A STATE OF THE STA



The "Morning Post."



The "Zodisc." "Colonel Renard," and "Ville de Bruxelles."





The Zeppelin harbor at Ducceeldorf. Note the wind break at the entrance.

TYPES OF RECENT AIRSHIPS

"Krell I" is docked partly by the aid of electric winches No doubt similar devices will be provided in the big new Zeppelin station at Frankfort-on-the-Main.

Just now inventive ingenuity is concentrated on the improvement of the airabily itself. The time will soon her tipe for a consideration of the problems here indicated of handling an airabily by machinery entirely. Of these problems, perhaps the most serious is the difficulty of anchoring an airabily in a high wind. In handling the "Krell 1" that problem is almost solved. The anchor cable is sel to the nose of the ship and there divided. The twenty-four single ropes into which it finally separates are fastened all around the envelope, where the diameter is no less than 20 feet. The Zeepelin company have had so much experience in landing and holding ships in storms that, in the opision of Director Columen, not a rod would have been bent on the "Deutschland I", and that ill-starred vessel descended in a nopen field instead of in a forest. It should be no more difficult to handle an airship than a "Linstitusic" but as it is, the "Linstitusic" is probably docked with greater facility than any plant dirigible of our day.

Difficulties in Building a Big Airship.

All other difficulties of building large airships are summed up in the well-known fact that as a structure

increases in size, the margin of safety does not increase in proportion. In other words, if you desire to build an airship 300 feet long on exactly the same lines as a successful sizehip 100 feet long it would be incorrect, from the standpoint of civil engineering, to scale up the parts of the smaller airship to the proportionate size of the larger airship. The sign "Morning Post," which is a "Lébudy" of 385,800 cubic feet claisage dine for line. There is but a single car, very close to the savelope at that. The smaller ships. It cannot be denied that the "Morning Post" crossing of the widest part of the English Channel in a strong wind and its journey from Moissons to Aldershot in five hours shows that the size some the Aldershot in five hours shows that the size must be very greatly increased before the structural

danger point is reached.
The design of the "Krell I." seems to embody the opposite principle, namely, that an increase of size beyond 105.896 cubic feet entails all the resources of a civil engineer to increase the margin of astety proportionately. There are not simply two cars finstead of one, but three, so suspended that the pull on the gas bag is all in a vertical direction—very different from the oblique suspension and pull of the "Morning Post." Hence, in the "Krell I." a minimum strain is exerted on the envelope. It is true that the hull of the "Krell I." is uncommonly slender, in apite

of the absence of a sufficient frame, the whitel the "Morring Pool" constitutive roll "Motorpay and the shape of the hull, the material, is sufficient to causin atreases only. From those considerations, it would seem to follow that the "Exal-L" with greatly excel the performances of the "Morenton Poop."

same tase perpensances or use "accentage recor." The new German military "M-N", displaying M-Rab cubit feet more than the "M-HI.," is provided with a very substantial stiffening frame. Stills, it is no designed that the load is divided in two. Its engine power exceeds greatly that of the "Moranta Peat." The new Austrian mammoth, "Stagel-Mannabarth, also has two coars, on "only "88,000 cubic feet displacement. But that vessel, too, is devoid of a stiff-sening frame. Count von Bepositiva second "Destachland" is considerably lightened without any fundamental change in plan or material because the sirders were re-designed more skillfully. The British rigid "N-I." which is very similar in tryps, is ordered to a superior material (Derahuntinus), and has been judiciously developed by havel officers. The still is that its angine power is higher, and ther tradius of action for the same displacement is prail to shall senior in the same displacement is prail to shall be supposed to the new "Deutschland" and the British "N-I" are nearly identical in design with the first Esposition of only 460,100 cubic feet. In neither case was it considered necessary to increase the margin of structural safety with the sixty with the sixty structural safety with the sent structural safety with the sent successory to increase

Aeroplane Propellers

By William McEntee, Assistant Naval Constructor, U. S. N.

THE coming of the aeroplane and dirigible has stimulated interest in propellers.

When the Wright brothers had arrived at the stage in their experiments where they desired to fit power to their acropiane, they very naturally turned to books and theories on marine propellers in determining the kind of propeller to use. Whether it was that existing theories were considered inadequate or that the data was considered incapable of extension to the sir is not known, but they have stated that they found it necessary to conduct experiments and evolve a propeller theory of their own for the purpose Among naval architects and marine engineers the

Among naval architects and marine engineers the propeller problem has been, and is to-day, one of the most fascinating and important that they have to deal with. Many will be surprised to learn that among them there is no commonly accepted theory asisfactorily explaining all the various phenomenn associated with the action of the propeller nor one that can be used to predict with certainty what a new type of propeller will do under given

circumstances. The marine propeller has been in use for over sixty years; its theory and mathematics have been attempted by many of the world's keenest intellects, including that of Rankine, yet at the present day there can searcely be a designer who would have the hardthood to say that a particular design of propeller is the best that could be produced for a particular purpose or that some other designer could not beat it by a considerable amount. The truth is that mathematics have not yet advanced to a size of fixelibility such as to permit complete treatment of the subject.

How well the Wrights have succeeded in this intricate and difficult matter may be judged from a simple comparison of the weights of their machines and the motor power required to make them it. Some of the other well known types of acroplanes thing at the same speed require of the other will known types of interior to the superior to the comparison of t

The two features in which their propeller differs most markedly from those used in other aeroplanes are large diameter compared with the thrust developed and low number of revolutions compared with speed through the air. These two features will be discussed later.

In general, the experience obtained with the water propeller should be capable of extension to the aerial propeller, though the latter differs from the first in an important particular. It has a marked advantage over the first in that it

works in a full which is practically perfectly elastic, and what is known as "cavitation," or holes in the water around propeller blades, cannot happen in the air. When the phenomenon of cavitation appears in twater there is always an under waste of power. As the result of some experiments made by Langley on serial propellers, he stated in 1891:

"Nowthatading the great difference between the character of the media, one being light and very compressible, the other a dense and very incompressible fluid, these observations have indicated that there is a very considerable analogy between the best form of aerial and of marine propeller."
The published data relative to actual results ob-

The published data relative to actual results obtained since that time are meager, but so far as they go they seem to bear out Langley's conclusion.

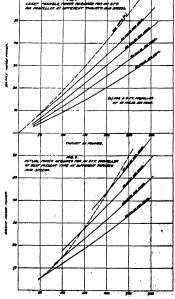


Diagram showing relations of thrust, horse-power and speed for 8-foot air propellers.

The following discussion is intended to give a general idea of the important elements of the aeral propeller and the limiting conditions affecting power, size, and speed:

If for instance it is desired to fit a propeller to an aeroplane weighing with operator and passenger 310 pounds, and requiring a thrust of 300 pounds to make a speed of 40 miles per hour with a motor of 30 brake non-power, it is of considerable advantage if there are means available to indicate that the result cannot possibly be achieved by using one 4-foot propeller; for in this case time and money will not be wasted in an effort to accomplish comething which is unpossible. If also there are means at hand which will indicate that this end can probably be more easily accomplished by the use of two 8 foot processily accomplished by the use of two 8 foot pro-

pellers or one 114-foot propeller, it will be possible to get a satisfactory propeller in quicker time and at less expense.

Dismeter.—One of the first matters to determins is the diameter or size of propeller to use in order to obtain the required threat without undus expenditure of power. The diameter is a very important element. The thrust or push of propeller ahead is the reaction it receives from threating or pushing a quantity of air to the rear. The air acted on at the propeller is limited to that which flows through a circle described by the tips of the blades. The quantity of air acted on therefore increases with the diameter, and as the thrust depends directly on the quantity of air and the velocity as which it is displaced to the rear, it follows that the greater the diameter the less rearward velocity need be imparted to it to obtain a given thrust. Thus approximately the same thrust will be obtained from an 8-foot propeller which images as Smile velocity to the rear as from a 4-foot propeller which imagers a 2-foot propeller which imagers a 3-foot propeller which imagers a 2-foot pro-

poller which imparts a 20-mile velocity. Many, of course, knew that of the total power developed by an aeroplane motor but a part is actually used in pushing the machine through the sir, the remainder does no useful work, and is lost. A considerable portion of the lost power querry is obtained in the air which has been pushed to the rear by the propeller. The amount of such lost power increases as the square of the velocity at which it is pushed assien.

In the case of the 4-foot and 3-foot propellers compared above, we should find that when developing the same thrust at a speed of 40 miles per hour, this lost power for the smaller one would be about three times as great as for the larger one. That is the underlying reason why small propellers are inselficient when used to develop relatively high thrust. A better appreciation of the principles involved in this will be had by those who have happened at some time to loss their paddle or once from a cause of the had by those who have happened at some time to loss their paddle or once from a cause of the hand. Though they worked possibly appeared than before, the effect delated was mostly in making small quantities of water agrees, subset

ng the best absad. Their propeller was

r to get thrust from a propeller it is abso An expert to get through from a proposer it is acco-tably miscenary to waste some power, because it is community to thrust at least some air to the rear. The age, amount which it is necessary to waste can be pured out, and this added to the useful power gives the least possible amount of power which would be required with a perfect and frictionless propeller.

The curves in Fig. 1 show this least power for an s-foot propeller at different thrusts and at speeds of from 30 to 60 miles per hour.

At a matter of fact no propeller can be expected to reach the theoretical limit. In water for the best type of propellers about 25 per cent more power is required than that indicated as necessary by theory. is, at this meed and thrust the smaller propeller requires 20 per cent more power than the larger one.

From the above it appears that the larger the dithe better, and this would be true but for fr tion and head resistance of the air to the propeller tion and head resistance, of the air to the propeller blades. This increases as the diameter is increased, and the power lost from this cause soon becomes as great or greater than that carried away by the air in the propeller race or wake. With other conditions coul and developing the same thrust, an S-foot pro-peller will lose from frictional and head resistance than the same three t about twice as much power as a 4-foot propeller.

Relation Between Diameter, Speed, and Thrust. It has been shown that if the diameter is made small there is excessive loss of power in the propeller race, or air pushed to the rear, and if it is made too large

per hour the diameter would be 33 × √100

- == 814 feet. 40

This agrees remarkably well with the results obained by the Wrights, who use an 81/2-foot propeller or this thrust and speed

The dotted line in Fig 2 shows this relation for an 8-foot propeller. This line crosses the power curve for a speed of 60 miles at a thrust of 210 pounds, and that should be the thrust of about the best efficiency. At a speed of 40 miles the best efficiency would be obtained with a thrust of about 95 pounds

Pitch .- Aside from the diameter the element on which the friction losses depend almost entirely is the pitch. The pitch of a propeller is the distance it ad-



A group of propellers experimented with by Maxim.





Voisin propeller. Steel arms and wooden blades.



Breguet's three-binded feathering propeller.



Fourteen hundred revolutions a minute. The black seg-nents are shadows cast on the rapidly revolving propeller



An R. E. P. motor directly coupled to a four-bladed R. E. P. propeller. Four-bladed propellers are almost obsolete now.



A Gaome motor directly coupled to Chanviere propeller.



TYPES OF AIR PROPELLERS



Four-bladed propeller on Paul de Lesseps machine.

The best air propellers require about 25 per cent more

the cest air proposers require accurs to per cent units of the control of the con wast to the theoretical power required in each case. Far example, from these curves at a speed of 40 miles a thrust of 100 pounds should be obtained with 34.7 banks horse-power. The Wrights get this thrust will should be house-power, which is in practical agreement with the above.

The Fig. 1 the dotted line shows the minimum power the medical processor as the secondary for a 4-feet propeller at a speed of the miles and at different throats. At a threat of the miles and at different throats. At a threat of the medical at horsespower is necessary, while for an account, and the minimum properties and the horsespower is required; that

A CAMPAGE SAFER SA

the frictional losses are excessive. The best size is

between the two extremes. In water it has been found that when cavitation does not occur, about the best diameter is given by

√T the formula d= where d is the diameter in Œ. feet, T the thrust in pounds, and V the speed of the

vessel in knots,

If allowance is made for the difference in the weights of a cubic foot of water and a cubic foot of air, and the speed is changed from knots to miles per

hour, the corresponding formula for air propellers is 33 V T

d == -v

For a thrust of 100 pounds and a speed of 40 miles

vances in the revolution when it is turning just fast enough to produce zero thrust. It is like the pitch of olt thread, that is the distance the nut moves along it when given one complete turn Aeroplane pro-pellers secured directly to the crank shaft of the motor must of necessity have a smaller pitch, while those which are driven by intermediate gearing or sprocket chains may have a large pitch if de-sired. The motor must run at a high cyced in order to develop its power without excessive weight, and if a propeller of large pitch is secured directly shaft, it would offer so much resistance to turning that the motor could not get up the speed

A common speed for such motors is 1,200 revolutions per minute. If the aeroplane makes a speed of 40 miles an hour, the pitch of the direct connected (Continued on page 190.)

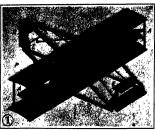
Automatic Stability of Aeroplanes

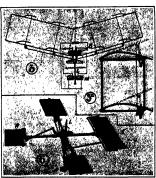
Comments on Some American Patents

By Grover Cleveland Loening, Author of "Monoplanes and Biplanes"

 Λ s FLYING becomes more general, the treacherous and shifty character of the air-ocean is more and more fully appreciated. The vast swirls and turmoils of the air are felt distinctly by all aviators, and the manner in which aeroplanes are wafted about on unseen billows and through invisible cross-currents is now familiar to many to watch for a few moments an aeroplane and its driver in full flight, silhouetted against the blue of the sky, to observe the coaseless motions of the aviator following the equally continuous quivers of his fragile craft.

To fly on a gusty day does indeed tax the nerve and endurance of many men, and it has long been recognized that, although the voluntary control of aeroplanes is well-nigh perfected, yet the disturbing





3. The J. D. Pursell patent stabilizing de entrolling system patented by P. R. Torbrand.

air forces are at times so sudden and so powerful that the aviator is taken unawares-often with disastrous consequences

great majority hold, therefore, that before flying can become as popular as motoring some practical form of apparatus that will hold the aeropiane in equilibrium automatically must not only be devised, but be applied successfully

The application of some methods has already taken place, and the actual operation of other methods that been devised will doubtlessly come within the year, so that it is appropriate and important to dis cuss the more noteworthy schemes and some of their particular features as exemplified in the ever-growing list of patents on "automatic stability."

There are numerous methods of attaining this

highly desirable end of automatic stability, the most promising ones being:

The employment of the inertia of a pendulum or other mass, to move or cause other agencies to move planes or rudders, for correction, as soon as the seroplane tilts from its normal position of flight. This method is more generally suggested than any other.

2. The employment of a gyroscopic apparatus which is designed either to hold the machine in perfect equilibrium itself, or else to "precess," and in doing so, move controlling apparatus to correct any tilt.

The use of auxiliary planes or light vanes, that travel in the air stream and upon a sudden inclination of the aeroplane, by their continual drifting in about the same line, cause the movement of rudders for the correction of the equilibrium.

The construction of the aeroplane of such materials and in such a manner that it possesses of itself an inherent elasticity, which causes it to be suspended in its element like a carriage on its springs. The Bréguet and Paulhan biplanes are notable types of this kind.

5. A rigid structure of such a form that it p a kind of automatic stability. The old Voisin, Pischof, Etrich, Warchalowsky and Dunne are types of this kind. There may be also included this class all those types employing the dihedral principle either laterally or longitudinally,

use of the movement of a compass needle to set apparatus in motion that will move the rudder so as to correct any deviation in direction; and the use of the movement of a barometer needle or other apparatus affected by the pressure of the air to control the rudders for altitude.

The manner in which a pendulum device is relied upon to give automatic control is best shown by reference to Figs. 12, 13 and 14 Fig. 12 represents a longitudinal section of an aeroplane, showing a pendulum control P for fore and aft balance and an elevator rudder E. The direction of flight is indicated by the arrow, and this same diagram the aeroplane is assumed to be in normal horizontal flight.

Fig. 13 shows the same apparatus immediately after a sudden gust has tilted the front of the after a sudden gust has titled the front of the machine up. The pendulum P, due to its inertia, has retained its vertical position P, but in doing so has pulled on the rod ad, causing the front elevator to assume the position E', and to receive the pressure of the wind on its upper face. This causes a downward force on the rudder surface which brings the machine back to the horizontal Fig. 14 represents the effect of a sudden downward plunge of the head of the machine

In the same manner, the inertia of the pen dulum is used to move side controls, when en transverse tilt occurs.

Of course the nature of the pendulum and the manner in which it controls the equilibrium is vastly different in many of the suggested methods but the fundamental principle is everywhere the same, the pendulum itself consisting variously weight, the weight of the car, th weight of the aviator, swinging on a movable shat, or the movement of a mercury bath.

There are four distinct objections to employing any kind of a pendulum device for automatic stability:

The first and most important objection is that, if the pendulum is at all heavy, it will tend when the machine is tilted, to accontuate greatly, the tipping. Thus, in Fig. 18, due to the fact that the weight P¹ has traveled through an angle O that the weight P has traveled through an angle O with respect to the frame, there will be a strong downward pull in the direction BA. This will certainly accentuate the downward force at the rear. due to the vertically downward component BC. If the weight is heavy enough and the inclination great enough this is likely to completely unbalance the

(b) Another effect upon a pendulum mechanism nat makes it distinctly undesirable is that if there is a sudden lurch of the entire machine either for ard or backward, or to either side, unaccompan by any tilting, then the inertia of the pendulum will it to swing away from the side to which the machine lurches, thus moving the rudders and actually disturbing the equilibrium of the machine by either making it rise, plunge or tilt over to one side. Due to "holes in the air," sudden side gusts and even variable propeller thrusts, such sudden lurches are various propeint inrusts, such sudden turpless are of frequent occurrence, and unless some means of "deadening" the pandulum is provided the equifibrium would be very unstable.

(c) The action of centrifugal force on making a

turn will cause the pendulum to assume a position parallel to the struts of the machine or any other normally vertical parts, and it will not fly out to the outside as commonly supposed. Its action in turning, therefore, is nil, and to make the turn positive it would be necessary to install a separate control. This arrangement assumes a proper "banking" of the

(4) After any displacement of the pendulum itself from its normal position due to a sudden movement from its normal position and a southern moreover or lurch of the seroplane, the pendulum will at once tend to swing back to the normal. If the period of this swing should just happen to coincide with the frequency of any vibration or sway in the machine or with any wave pulsations of the sir stream, then the swinging would continue and be amplified, e



ented pendulum system of automatic centrol.



7. A typical example of an early natented flying m

ally destroying the equilibrium of the machine chronism of this sort is not at all unlikely to happen, for air waves are known to possess pulsations at regular time intervals; and in addition, propellers have often been found to give continuously and rhythmically varying thrusts, causing a slow swaying vibra-tion in the heroplane, quite distinct from the vibration of the motor.

It appears, therefore, that the use of a pendulum for preserving the stability of an aeroplane is limited in its action to the condition of comparatively steads horisontal flight, and is hardly feasible in very gusty

was patented by E. P. Johnston on June 5th, 1886 (U. S. Patent No. 283,889). The flying machine described is of the helicopter type, in that it is provided sorthed is of the nestcopter type, in that it is provises with four lifting screens, two of which, A and B, are shown. Any inclination of the ship either transversely or longitudinally sets a pendulum in motion, which, by means of an electric contact, governs the which, by means of an electric contact, governs the operation of the motive power to the propellers, so that the lift on the depressed side in increased. In addition, it is interesting to note that the passage and covers the shifting of the passage as

TO THE POST OF THE

equilibrium, however, in this device, the pendulum

The well-known automatic control of the Wrights,

patented both here and abroad, relies upon the mov?

ment of a pendulum mechanism caused by the lateral

tilting of the aeroplane, which actuates a valve con-

trolling the admission of compressed air to a cylinder,

thus moving a piston and by suitable connections

operating the warping of the planes and the rudder

alone being relied upon to keep the

even keel transversely

There is no voluntary control of the lateral

movement of a needle N on a dial D, thus indicating to the operator the state of equilibrium of the

A similar electrical control of the power supplied to lifting propellers by a pendulum, was patented in England by I. A. Colquhoun on July 32th, 1907, 81r. Hiram Maxim, no April 23th, 1887, patented, in England, a pendulum device actuated by the tilting of the machine, and thus controlling the power of the engines which drive the propellers so that the machine is automatically righted.

Sylvanus S. Morrison, on October 11th, 1910, patented a device

(see Fig. 10), in which the is piv-to the changin (U. S. patent No. 972, als C, due to its inertia. is suppo stay in a nor mal position. The tilting of p plane on any side, by means of a suitable system of levers, shafts and gears, causes the entire motor and ordinary vertical propeller system 8 to be turned around tal turntable T thrust of the

the air thrown

-1140

0000

8. An early helicopter patent. 9. An auxiliary plane system for automatic balance. 10. Pivoted plane and propeller system patented by S. S. Morrison. 11. The E. P. Johnston device for automatic stability.

back by II, is directed against the lowered side, thus, due to the increased draught of air, causing it to lift up. On March 27th, 1906, the I. C. Hansen-Bilehammer device was pestated in Engiand. It consists merely of the system abown in Figs. 12, 13 and 14, in which of the system abown in Figs. 12, 13 and 14, in which up the system abown the system and an elevation runder, and upon the tillting of the machine up on down the insertia of the weight causes the runder to down the insertia of the weight causes the runder to

be moved for correction.

The supplyment of the movement of a mercury hath instead of a weight was patented by I. D. Pursell on October 22nd, 1907 (U. S. patent No. 889,018). The mercury is contained in a barrel B (see Fig. 3), and when the seroplane tilts the mercury runs to the lowered end of the barrel, thus closing a circuit and operating an electromagnet M, which moves a lever L. causing the rudders or side warping control to be set for correction of the equilibrium

The C I. Lake patent of April 18th, 1909 (U S. patent No. 318,358), covers essentially a fluid jet propiled apparatus (see Fig. 3) equipped with a pendulum P (Fig. 2a) caused to swing by the tilting of the machine, and by thus opening certain passages and changing the fluid movement, the apparatus is brought back to an even keet.

F. H. Wales, on August 2nd, 1310, patented a system for automatic stability (U. S. patent N. 985/589). The car or other heavy movable weight W (see Fig. 4) is privated to the frame F, and upon the titting of the machine to any side the car, remaining normal, causes the entire plane P to be shifted boilty over to the depressed side by means of a toothed segment and rack. The lift on the depressed side is thus horeased.

On Documber 14(n. 1999, the pioneer James Means patented a pendulum device that has many advantages because, all the inversenate of the pendulum P(FE. 5) and rudders R are easily in central of the aviator through a handle bar R, which is part of the pendulum lever and moree with (thus preventing coentric motions of this pendulum. In addition, positive voluntary movement of the rudders is possible. If the seropiane piunges head down, the pendulum P swings forward. (with respect to the frame), and by manse of a gent and nead; tunns the rear elevation rudder for ascent. If there is a sudden tilt down to the seropiane piunges head the sudden tilt down to the seropiane piunges and the production of the tilt bevel gearing, in such a manner that the side alienns are mored invessely for correction of the tilt.

are moved inversely nor correction of the tit.

The F. R. Forbrand automatic control, patented on floplember 30th, 1910 (T. E. patent No. 970,974), is similar in many respects to the Means device. The psynthema F (Fig 6) controls the interal and longitudinal equilibrium by moreasent of allerons and rudders. A lever L, when moved forward and back, gives displaying the present of research of the control of the alleroid or the development of research and con-

The Presery automatic control (see Fig. 1) is about the simplest and most effective yet devised. In this system very little weight is added, since the pendu lum weight R consists of the aviator seated in a swinging seat. Any sudden till of the machine causes him to swing in such manner with reference to the planes PP that the usual rudder or alterion operation at once takes place. In addition provision is made for 'locking' the seat, thus enabling voluntary control of ascent or descent AA are the alterions, EE the elevation rudders and R the direction rudder.

The precession action of the gyroscope offers an excellent solution to the problem of automatic equilibrium, but its action is so complicated that if its operation is not thoroughly understood there is likely to be great contraion in the preceivation of the equilibrium. When any disturbance occurs, there is little doubt that a gyroscope solidig fixed to an aeroplane

11

Figs. 12, 13, and 14.—Showing the manner in which a needless preserves stability.

will cause great internal stress in the framework supporting it, and will only slightly affect the equilibrium, while it is certain that turning in any direction would be practically impossible if the kyroscope is strong enough

But if a light gyrescopic apparatus is installed, capable only of operation of the controls by its motion of precession, there is great possibility of an absolutely automatic stability. The Marmoniner and Reg nard gyrescopes are devices of this sort Up to the present, however, such devices have been found very delicate and difficult to handle, and the refinement re-

quired in their construction is great and ex pensive, while in any very turbulent con dition of the air the action becomes so complicated that the apparatus merely jerks the rudders in

every conceivable direction

A very simple and effective means of using gyroscopic force, however, is that described in the patent of A M Herring The aeropiane is equipled with two propellers relating in the patent of the control o

matic stability. Wright machine The propeller shafts are mounted on ball and socket joints in such fashion that they can swing in a horizontal plane without whether the deliver from the

In such fashion that they can swing in a horizontal plane without affecting the drive from the motor shafts. The propeller shafts are prevented from swingting in vertical planes. When the aeroplane in flight titls up or down, longitudinally, the propeller shafts, due to gyroscopic action, will either swing toward each other or away from each other. This movement is communicated to the elevation ruider by sulfable means and causes it to right the machine.

The employment of auxiliary planes or vanes that are designed to fly out in the air stream under all conditions of equilibrium of the acropiane is a very simple method of attaining automatic stability, and one that promises much, as soon as the actual nature of the stream flow about an acropiane is fully determined

Capi. Effect recently installed a device of this kind on his French Wright machine. A light hinged van was permitted to flap freely in the air stream at the rear of the accopiane, and was connected to the slevation rudder at the front by a lever system. Whenever the accopiane tilted longitudinally the vane caused the rudder to move in such a manner that the machine was righted.

The Wright automatic stability patent makes use of a vane of this kind for longitudinal equilibrium, the movement of the vane actuating a valve controlling the compressed air supply to a cylinder, the piston of which operates the elevation rudder.

Elasticity of structure of the planes, as on the Paulhan and Brigute, gives a certain degree of ability A sudden downward gust on one side, for example, due to the great flexibility and "give" of the plane, will increase the angle of incidence on that side, thus momentarily increasing the lift and counteracting the depressing effect of the gust

On the Briguett the rear cruciform tail is mounted and held by light springs. A sudden unward gust on the tail will thus cause it to give way a little and be turned in such a manner that the increase of air pressure on the upper horizontal face will force it down, counteracting the upward gust. This is an admirable provision, and gives a remarkable degree of stability.

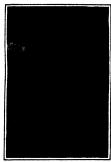
The "box kits" structure of the old Volsin type and the consequent hold it had on the air is well known as is also the upturned wing ends of the Pischoff. Eirich and Warchalowsky acropiance and the manner in which they tend to automatically hold the machine on an even keel The Dunne principle of a V-shaped (Continued on page 45)

Some Famous American Aviators and Designers

Men Who Are Making Flying Machine History



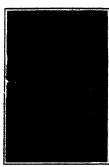
Charles K. Hamilton, America's most during biplane operator.



Thomas Scott Baldwin, an old airship captain now an aviator.



Charles A. Willard, first pilot of the Aeronautical Society.



"Bnd" Mars, the Curties aviator, who has made many cross-country flights.



Wilbur Wright, the elder of the two brothers who built the first practical aeroplane.



J. Armstrong Drexel, American million-aire-Blériot pilot, noted for his altitude flights.



J. A. D. McCurdy, the Canadian Curties pilot, who flew from Key West almost to Havana.



Walter Brookins and his "Baby"
Wright. He invented the
spiral dive.



Glenn H. Curtins, winner of the Scien-tific American trophy. First to rise from water in a biplane.

Earle L. Ovington, the first American to pwn and fly a 70-horse-power Blériot monoplane.





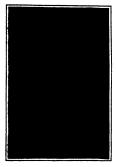


Some Famous European Aviators and Designers

Men Who Are Making Flying Machine History



recentative in the maett Cup race.



Claude Grahame-White, England's leading aviator. He wen the last Bennet' Cup race.



tor, who has made records with both monoplanes and biplanes.



who won a \$4,000 prize by his 400-mile flight from Paris to Pau in 6 h. 55 m.



mer all but won the \$30,000 prise cap-tured this year by Renaux.



Louis Blériot, France's premier mono plane inventor; first to cross the Eng-lish Channel, July 25th, 1909.



Pierre Prier, the Frenchman who flew from London to Paris without a stop at over 60 miles per hour.



Morane, the former Bleriot pilot, who has invented an exceedingly fast and efficient monoplane.



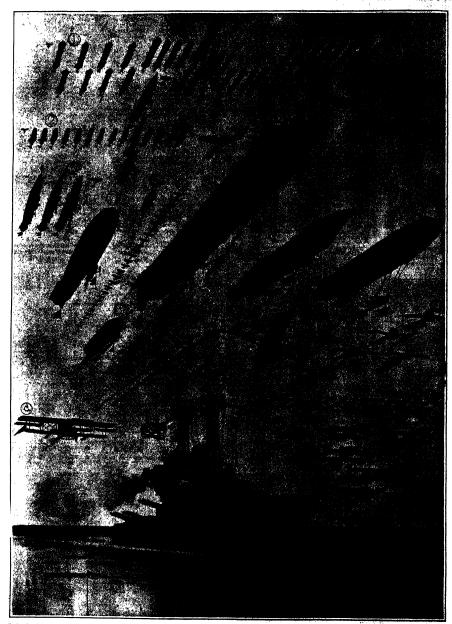


Louis Bréguet, leading Frénch inventor and aviator. First to carry live load equaling weight of machine (11 passengers).



Robert Esnault-Peiterie, inventor and designer of R. E. P. monoplane. He is one of the best aviation sugineers of the day, collection of the day.





Explanation of the above refer are degree, etc. 1. Squadron of 20 Zepopelius (Developanchow). 2. Squadron of 12 Parsersis in command of 2. Laboraty (circular). 3. Squadron of 20 Zepopelius (Developanchow). 4. Squadron of 2. Squadro

Some mistaken outhusiasts believe that the money put into battleships would be better spent in creating fleets of airships. Both will be required—battleships for the warfare of the sea; acroplanes and diricibles for the battles of the six.

A Ten Million Dollar Aerial Navy for One Dreadnought

Naval Aircraft Will Never Supersede Cruisers and Battleships

I N the development of a new art, particularly when it makes such a phenomenal advance as has marked the recent progress of the airship and aeroplane, the public is liable, in its enthusiasm, to ascribe to the new investion capabilities which are far beyond its present powers. Particularly in regard to the art of this tendency made manifest, and nowhso much as in respect of the usefulness of airships

nd aeroplanes in warfare.
Not infrequently the argument has been made, both from the platform and in the press, that the vast sum of money which is expended in creating a single dreadnought might better be devoted to creating a whole feet of dirigibles and sereplanes. That the y cost of one dreadnought would be sufficient to a fleet of serial craft cannot be disputed; but to argue that such a fleet would have the same prac-tical usefulness as the one mighty ship is an altogether different proposition.

The consensus of opinion among naval and military men at the present time indicates that they believe the immediate sphere of usefulness of air craft will lie in the work of scouting, for which they will prove

to be simply invaluable.

The serial scout will change the whole system of The aerial scout will change the whole system of strategy, and this for the reason that it will render impossible that secrecy upon which the sphole theory of strategy is founded. We showed many months ago that the commanders of two opposing forces will henceforth be somewhat in the position of two chess players, each of whom has a fairly certain knowl-

edge of what the next move of his opponent will be. There is probably no country to which the introduction of aeronauties into the domain of naval warfare is fraught with such serious possibilities as it is to Great Britain, whose very existence as a first-class power depends in the last analysis upon the main particular importance to a recent discussion of the subject by leading officials of the British navy, in which it was agreed that the advent of the aerial scout would have but little effect upon the design of future battleships It was agreed that airship must fight with airship, aeroplane with aeroplane; and that just as the security of the island was preserved by maintaining a navy of overwhelming force, so Great Britain will be driven to the necessity of building fleets of dirigibles and aeroplanes which will show a similar preponderance to any probable combination of the aerial fleets of other powers.

At the same time, it is certainly interesting to study

the accompanying fanciful sketch which our artist has drawn, showing a modern dreadnought stripped for the fight, and above it, a composite fleet of dir igibles and aeroplanes, whose cost would approxi-mately equal that of the single warship He finds that for the ten million dollars expended on the ship, it would be possible to construct 30 Zeppelins, 14 Parsevals, 5 Lebaudys, 1 Deutsch, and 2 small scout airships, making a total of 52 dirigibles, at a cost of \$8,760,000. The remaining \$1,240,000 would suffice for the construction of 118 Curtiss biplanes, 75 Wright

biplanes, 29 Blériot monoplanes, 8 Antoinettes, 4 high ed all metal machines of the type described in the Scientific American of October 22nd, 1910, and one Farman biplane. Thus, according to the estimate of our artist, for the cost of a single dreadnought, it be possible to put in the air no less than 287 air craft

For identification (in the picture) noughts" carry square flags, fore and aft, the "cruisers" a "swallow-tail" two-pointed flag, and the "scouts" a single point flag. The "dreadnought" marked Z in the drawing is directly over the "North Dakota," that the relative sizes can be noted. The marks D. L and P indicate three "cruisers" on a line with the "Zeppelin" The aeros marked c, f, w and b are on a line with the "Dakota" The 52 dirigibles depicted are provided with life-boat cars, and the 235 aeroplanes are also hydroplanes Dirigibles are rated something as follows. "Dreadnoughts," 300 horse-power, 450 feet by 42 feet; "cruisers," 135 horse-power, 200 feet by 36 feet; "scouts," 30 horse-power, 90 feet by 19 feet

Let it be understood that no such darkening of the air by a multitude of aerial craft, crowded as they are shown in the picture, would ever be possible The disturbance of the atmosphere caused by the wash of the various machines would, of course, throw the craft out of equilibrium and render them unmanageable. If ever the flying machines of the future maneuver in large bodies, it will be necessary to scatter them over a wide expanse or arrange them in succossive planes at varying altitudes.

Aviation Prizes at Home and Abroad

More Than a Million Dollars to Win

M ORE than a million dollars in prizes has been offered for special flights and for improvements in seroplanes during the balance of the year 1911.

As will be seen from the list printed below, America is as far behind Europe in the giving of prises as she is in the flying of machines. The great progress which has been made by the French in aviation has been chiefly due to the encouragement received from wealthy men, manufacturers, and newspapers, in the shape of large prizes for performing feats in the snape or large prizes for performing seats in the air. Perhaps no one in the entire world has done more for the development of aeronautics in this way than Senator Henri Deutsch de la Meurthe, whose name still figures in the list of prize givers.

Probably the first cash aviation prise offered in America was that offered through the Scientific American by Mr. Thaddeus Hyatt July 25th, 1860. This prize of \$1,000 was never competed for or won. Again, in 1907, the SCIENTIFIC AMERICAN itself put up the Scientific American Trophy, which was won three years in succession by Glenn H. Curtiss, now its permanent possessor. Last year Mr. Edwin Gould made a generous offer through the Scientific American of \$15,000 for the machine equipped with multi-motors and multipropellers that makes the best performance in a flight of one hour. The rules of this prise appear in this issue. July 4th is the date fixed for the tests of the machines entered. Last summer, after the \$10,000 prise offered by

the New York World for a flight from Albany to New York had been won by Glenn H. Curtiss, this news paper put up another prize of \$30,000 for the first aeroplane flight from New York to St. Louis in a period of 100 hours. The New York Times also ered a prize of \$25,000 for a flight from Chicago to New York. Neither of these prizes was competed to New York. Neither of these prizes was competed for, and both have been whithdrawn, although if any sportsman aviator comes forward and wishes to at-tempt the former flight, the prize will no doubt be found awaiting him. The New York American, last San Francisco to New York the time allowed being thirty days. This prise offer is open until October. 11, 1911.

For the perfecting of the aeropiane motor, the Automobile Club of America has offered a prize of \$1,000 for the motor which makes the best performance in a three-hour continuous test. The date of closing of the entries for this contest is July 1st Full particulars regarding it can be obtained from the cretary of the Automobile Club. been open for a year past, but as the rules stipulate that three motors must be entered for competition in order that the prize may be won, and as the requisite number of contestants has never been tained, there has been no competition thus far. In a contest for a similar prize limited to English motors and offered by Patrick Y Alexander for a 24-hour continuous run, a four-cylinder aeroplane motor known as the "Green," proved to be the best, and Mr Alexander has since put up another prize for such a

LIST OF PRIZES IN AMERICA, ENGLAND AND THE CONTINENT.

PRIZES IN AMERICA. Automobile Club of America's motor relia-15,000 World prize for flight from New York to St Louis (tentative) Hearst prize for flight across the continent . . PRIZES IN ENGLAND Manville prize (British aviators only) for long distance flights on nine specified dates. Michelin prize for longest flight above an aerodrome during 1911 Patrick Y. Alexander's engine reliability prize 5 000 Gordon-Bennett Cup race prise (July 1st)... London Daily Mail 1,000-mile race around Great Britain, starting July 22nd at Brook-5,000

PRIZES ON THE CONTINENT	
Fastest flight from Nice to the Island of	
Corsica	\$2,000
L'Auto prize, Paris to Bordeaux	2,004
Rene Quinton prize for longest distance vol-	
plane (glide)	2,000
Aero Club of France prize for longest circular	
flight	2,000
National Aviation prize, Paris to Orleans .	4,000
Tour of the South of France	4,000
French Ministry of Works prize for French	
constructors	4,000
Dufayel prize, Bagatelle to Lettarre	4,000
Aero Club of Bearn prize, Paris to Pau (won	
by Vedrines on Morane monoplane) .	4,000
Michelin prize for longest distance above an	
aerodrome in France	4,000
Quentin Bauchart prize for passenger car-	
rying	10,000
Pommery Frères prize for longest straight	
flight (French aviators only)	10,000
Deutsch prize for circuit around Paris	12,000
Let Petit Parisien prize, race from Paris to	
Madrid, starting May 21st	20,000
Automobile Club of France's Grand Prix .	20,000
L'Aéro's prize for flight across the Mediter-	
ranean	20,000
German Circuit, finishing at Berlin	40,000
Aix-les-Bains meeting	40,000
Circuit in Saxony, starting at Chemnitz	
May 20th	47,500
Over-sea Circuit, Calais-Dover-Folkestone-Bou-	
logne	60,000
Petit Journal prize, Paris to Rome, starting	
last of May	80,000
The Standard, Le Journal, and other papers,	
Circuit Paris-Brussels-London-Paris, start-	
ing June 18th	85,000
Russian aerial tour, starting from St Peters-	
burg	100,000
French Government competition for military	
aeroplanes	240,000
Prizes at meets and circuits in Germany.	

Rapid Increase of Life

A B illustrating the enormous powers of rapid in-crease exhibited by both the animal and veg-table ithughoms, which have insured the continuance of the warrous types of existing life from the earliest

colorical ages in unbroken succession, while being an important factor in the production of new forms by adaptation, the following instances may be cited:

lands

50.000

A common weed, the Sisymbrium Sophia, produces three-quarters of a million seeds, and these, if they all grew and multiplied, would in three years cover

the whole land surface of the globe Darwin calculated that the slowest breeding of all animals, the elephant, would in 750 years, from a single pair, produce 19,000,000 individuals Rabbits would, from a single pair, produce 1,000,000 individuals in four or

Italy, Russia and Belgium

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Instruments Used by Richard Strauss

In the attempt to obtain realistic effects in orchestration, Richard Strauss is a past master. His "Symphonia Domestica" is a pretty accurate phonetic reproduction of household troubles and joys. in his "Death and Transcription," the battling of a man with death on a sick-bed was musically portrayed with almost frightful reality. ln "Electra" all the resources of the modern orchestra

were drawn upon to call forth dramatic effects so crassly real that many & hearer was more horrified than pleased. Our German contemporary, Ueber Land und Meer, publishes the accompanying illustra-tion of some of the more emarkable instruments which Strauss uses in obtaining his effects Some of them are hardly musical instruments, but merely noise producers, and a few are by no means new.

Muffled drums have always been used in funeral marches, and Strauss, too, employs them whenever lugubrious opportunity offers Every melodrama in which a thunder storm figures includes among its properties a huge drum Strauss's drum is a good deal larger and flatter than the ordinary bass drum which produces Jovian thunder and booming artillery. The effect of rushwater and hissing steam is produced by the simple expedient of rub-bing a drum head with brushes The musical porbrushes The musical por-trayal of lighting necessarily calls for an instrument of incisive sound Hence, in connection with the thunder drum, a cymbal is used, which is struck with a felt-covered The cymbal and the thunder drum are companion instruments. tanets and triangles are familiar instruments, and Strauss employs them chiefly for heightening chiefly for heightening the rhythmic effect of The trampling of horses and the dancing of negroes is very realis-tically mimicked by means of a Chinese wooden drum, which is beaten with tubular sticks Similar in their character are

the 'glockenspiel" and the "tubaphone," both of which are not particularly new, but rarely used. The plashing of rain is imitated by means of a hydro-phone, a drum which is filled with small stones, mounted upon bearings and rotated The cracking of whips is reproduced by means of wooden clappers which are similar to those which small boys use.

The Plague and Its Spread

I N a paper appearing in the Journal of the Royal Society of Arts. J. Cantile publishes a discussion of peculiar interest on the mode of occurrence and spread of the plague. The phenomena presented are somewhat complex, and far from fully explained There are certain aspects in the situation that are somewhat disquieting—the disease exhibits some prop erties of a very insidious character. We quote the writer in his own words:

"The prevalence of plague in the world in epidemic form since 1894 to the present moment-a period of

sixteen years—is a matter of supreme interest and im-portance to the people of every nation. The question naturally arises at the moment: Has the virulence of the malady spent itself, and may we look forward to an abatement of the pandemic, and a hope that it may speedily disappear altogether? The history of previous epidemics does not engender a hopeful answer that it may do so; all previous outbreaks indicate the long continuance of plague among every community in which it has gained a serious hold. It

Kumaon and Ghurwal, on the southern slope of the Himalayas; but whether this is the only home of the disease, or whether there is, in addition, another in Mongolie, and yet another in East Africa, is not known. It may be that in no part of the earth is plague endemic among men, but that the disease is kept alive only among certain animals, and now and again in the history of the world does it attack man. There is much to be said for this opinion. Certain animals, especially of the rodent class, seem to

be liable to playie in an epidemic form, but whether it is endemic smong these animals is not known. That plague is endemic among rate is not known. That it occurs dantly proved, but whether it is the rat that keeps the bacillus alive from one century to another seems uncertain, and it is un-likely from the very fact that it is so virulent among them at times. There is some evidence that the marmot may be the true barborer of the plague infection.

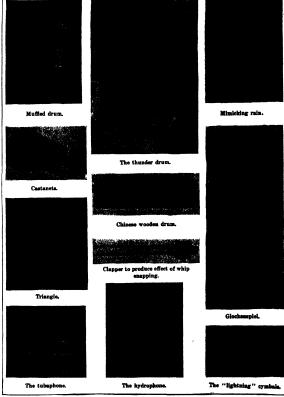
"Plague manifests ite presence in man more frequently in the form of bubonic piague than in any other form. In Bib-lical times even the bubo or emerod, as it is spoken of in Leviticus and I.

Samuel, was the promi-nent evidence of the presence of the disease. Surgically a bubo means an enlargement or swelling occurring in a gland any where in the body, due to some irritation or inflammation in its neighbor-hood. In plague there are three situations in which buboes may be felt. Most frequently it is the groin glands that enlarge, but the glands of the armpit and the neck may be the seat of the swelling. The bubo, however, is not the first indication of the disease: in fact, it is rather late manifestation, for it may not be until the third day or later that !t shows. Like other infections, plague begins with feverishness, headache, backache, a feeling of chiliness, or even a rigor; there is a loss of appetite, foul tongue, usually black in center, and con gested throat: vomiting is and diarrhose or constipation obtains;

mental aberration is an early manifestation, and may continue throughout the illness. As a rule, if the tient lives over the fifth day, recovery may be ex-pected, and the third and fifth days of the illness are the most dangerous. If the eighth day is survived, the hope of recovery is good, the chief danger then being failure of the heart through sudden movement or getting out of bed, walking across the floor, and

leaning over the verands or staircase railing.

"The pneumonic form of plague we have facat
about especially in the spidemic which is new raging
in North China. It is an acute form of the disease. which attacks the lungs so extensively that death comes in two or three days. It is highly infectious, comes in two or turne days. It is inguiry inscending, una rapidly through a household, and course with such rapidity and virulence that there is no time even to bury the dead. The plaque in North China rebells the accounts given of plaque in former estimates in the accounts given of plaque in former estimates in the surrous and abroad in the limit of the limit of the surrous. In the surrous is abroad in the world. We head to understand, then



SOME OF STRAUSS'S ORCHESTRAL INSTRUMENTS

is not a question of a prevalence for a few weeks or months or even years, but a continuance for several decades in any populous district where it has found a footing. In London, when plague last visited us in venteenth century, although the mortality high for only a comparatively short time, local outreaks occurred for a long period, and sporadic o until the beginning of the eighteenth century. ing even by the behavior of the present epide plague has lasted now for seventeen years in Southern China, and for fifteen years in India. Speedy fitsay pearance of the disease from regions severely attacked is, therefore, not to be calculated uponlong continuance is rather to be expected. It is this characteristic of plague which causes the disease to be dread as it is, for it is the only malady which prevalls in epidemic form for a number of years in any given country.

"The endemic home of plague among human beings is a matter of doubt. So far it is beliaved that plague is always present in the Indian provinces of

The same of the sa

curious phenomenon which has been observed in that the occurrence of the plague is apt to be precede rsor, taking the form as it were of a mild by a proct form of plague, termed posts minor, which is epi-demic, but comparatively harmless. In fact, all aprances seem to indicate that the disease runs agh a regular cycle of development stages:

(1) Pestis minor. Bubonic plague

. . .

(3) Pneumonic plague.
That these are related the one to the other would seem incortestable; that each possesses a special variety or type of virulence due to peculiar characters of its becilius, and transmitted in different ways in h type, would also seem true. That rat-fies in tion plays, no doubt, a part in this scheme, but, as Dr. k, of Calcutta, remarks, it is but a link in a chain of some length-a chain, we would add, in other animals and man play a part.

"This part of the question is of special interest, because it may be of importance in estimating the approach of plague in any country, and it would be well to keep this point in view in our hospitals in this country, and to watch if cases of huboe are h more prevalent. In this way we might hope to gage

the proximity of true plague in its virulent forms.
"The facts seem to be that there are three stages in this disease. Pestis minor, carried only by insects from diseased animals, is always local—a household outbreak, in fact—in which a pseudo-plague bacillus is found in man. Bubonic plague is carried from man to man by insects. Pneumonic plague passes from man to man without the intervention of insects. The viru lence of each variety gathers in intensity. Time is required for one type to change to another more viruient, each variety propagates its like until, by pro-longed cultivation in the blood and tissues of a particular animal, or in man, it changes its type and becomes specific for that animal. As the tuberculosis of animals may in time and in suitable soil change in type, so that it develops in man, and then is directly transmitted from man to man, so is plague in time attered in type, so that it no longer requires an animal host, but in times of epidemic passes from man to man, and becomes wholly a disease of human beings.

The stages would appear thus to be:
(1) Disease in animals.

4(1)

Pestis minor, conveyed by infected insects. "(3)

"(8) Bubonic plague, sporadic cases, carried from animals to man by insects. Epidemic bubonic plague, carried from man

to man by insects. Pneumonic plague, passing from man to man

directly, or conveyed by insects.

"It would seem, therefore, that severe as bubonic piague has been in China and India, yet a worse form may develop, for pneumonic plague is the culmination of this chain of virulence, and China and India may have been but the fostering beds in the development of the bacilius which has now attained its highest deent in Manchuria, and may pass over the vecogament in manchuria, and may plass over the world, as it has frequently done before, in the form of the Black Death. At present, science offers no means of preventing such a calamity, except it be a such as Haffkine's proj hylactic which would seem to have done good service in India, bubonic plague has chiefly prevailed.

"Infection by rat fless is sufficient to explain sporadic cases of bubonic plague, and plague en-demicity, but it is wholly inadequate to explain an epidemic of bubonic plague which can only occur by infection from man to man, possibly by insect

"An important point to be observed in the epide closy of plague is that animals, chiefly rodents, the rat in many places, the marmot in North China, the in the United States, etc., may suffer from plague for years without infecting mankind, except in a sporadic way. Then suddenly an outbreak occurs which prevails in an epidemic form. In Northern ina this has been proved to be the case, and in any Conna tails had been proved to be the case, and in any observey where redents are infected, the same se-quence may be amicipated. Rats have been found to be inflicted in Britain, in Glasgow, in the Port of m, and in Suffolk; also in Germany, in Hambound, and elsewhere; squirrels are known to be in-fected in the United States, more especially on the Pacific sleps. In these countries small outbreaks of The sublect, reaching from experience, is not long-thic depth of the sublect of the sublect of the sub-field of the subject of these countries are dwelling in the subject of the subjec

Contract of the second

High-frequency Generator for Wireless Telegraphy

T is announced in the daily press that Dr. Goldschmidt has recently succeeded in sending wireless seages from Berlin to the Southwestern frontier Germany, using his new high-frequency alternator to generate the electric oscillations. The production of amped waves by means of high-frequency alterna tors has been the aim of numbers of inventors, as it is hoped that by producing a suitable generator it may be possible to avoid the defects of working that are associated with the usual arc and spark methods. The subject, with especial reference to Dr. Goldschmidt's method, is discussed in Nature by A. Makower. This author writes:
"A number of alternators have been built, but owing

to various reasons none of them has as yet come into extended use. Their design on the usual lines is very difficult, as even if the rotating parts are made to revolve at the highest speeds permissible from mechanical considerations, the number of poles required to produce the high frequencies necessary for wire less telegraphy is so great as to leave very little room for the windings, and the consequent cramping of the windings and great leakage between the closely poles give rise to considerable drop of voltage when

load is put on the machine.
"Most of the machines that have been constructed hitherto have been of the inductor type, consisting of fixed windings paced under the influence of rapidly rotating armatures of iron containing a large number of projections or teeth, but the Goldschmidt machine is built on a quite different principle

"It is a phenomenon well known to those who have to work with single-phase alternators that when load is put on such machines the armature reaction causes double-frequency currents to flow in the field winding and that these double-frequency currents cause triple frequency currents to flow in the armsture winding so on. This may be explained by the consideration that a stationary alternating flux can be regarded eing composed of two equal and constant fluxes rotating with equal speeds in opposite directions, the speed of the two fluxes being such that one complete revolution is made by them in the time of one period the alternating flux.

"Applying this to the case of an alternator with sary alternating-current winding and rotating field system, it will be seen that if the rotating field uces alternating currents of a frequency f in th stator, the component rotating fields produced by the stator currents will rotate at the same speed as the field system, one in the same direction as the field ng, and therefore having no inductive effe it, and the other in the opposite direction, and there fore inducing a current of a frequency 2f in it continuation of this process would cause currents of frequencies 2f, 4f, 6f, etc. to appear in the field winding, and currents of frequencies 3t, 5t, 7t, etc. to appear in the stator winding. The production of the higher frequency currents in ordinary alternators is limited by the fact that the amplitudes the series of harmonics decrease rapidly, owing to the at impedance opposed to their flow in the windings but the triple-frequency harmonic superposed on the fundamental is often sufficiently marked to cause un-desirable distortion of the wave-shape of the electromotive force of the machine
"Dr Goldschmidt has constructed a machine in

which the effect referred to is utilized to produce currents of very high frequencies, although the funds mental frequency of the machine is comparatively low In order to prevent the damping out of the higher harmonics, he connects in parallel with the stator windings a series of capacity-inductance shunts tuned to resonance with the odd multiples of the fundamental frequency of the machine, and in parallel with the field winding a series of such shunts tuned to resonance with the even multiples of the mental frequency. Owing to the presence of these shunts the high-frequency currents are able to attain considerable magnitudes, and the electrical energy is reflected backwards and forwards between the stator and motor of the machine a great number of times, and motor of the machine a great number of times the frequency of the oscillations being increased at each reflection until a frequency corresponding to the free period of the radiating circuit is

'In Dr. Goldschmidt's machine, oscillations of 120, 000 cycles a second are produced, and the rated output is 12 kilowatts.

"Practical experience of working will be nece before it is possible to say to what extent machines of this type are likely to replace the present oscillation generators, but it seems not unlikely that difficulties will arise in seeping the frequency of the oscillations constant enough to enable clear signals to be re-

Why an Engine Moves

WHY does an engine move? The following is the simple explanation of Railway and Locomotive Engineering:

"Let us confine our attention to one side of an ordinary locomotive, with 20x24-inch cylinders and 56-inch driving wheels, and a boiler pressure of 200 pounds The master mechanics' rule for the mean effective pressure in the cylinders is 85 per cent of the boiler pressure, and in this case it amounts to 170 pounds

"This engine has a piston area of 51416 square inches and 170 pounds on each square inch imparts a total pressure to the piston of 53,4072 pounds, but the sake of facilitating the calculation, let us say 53,400 pounds M E P With piston at the back end of the cylinder and clank pin on back quarter. end of the cyninger and craims pair on both account or just above it, the pull of the piston on rod, cross-head and main rod reaches the pin. The wheel is a lever with fulcrum on the rail. This fulcrum changes from moment to moment as the wheel rolls along, and the point of contact between wheel and called the instantaneous fulcrum, as the length of the lever or the operating part of the wheel above it changes momentarily It is easy to see that if the crank pin is ever so little above the center line of axle the pull of the main red will turn the wheel and the engine will move forward. The effective pull as we have seen, was 53,400 pounds, and this is applied to the whoel lever of maximum length when the rank pin is on the top quarter, for this is 40 inches above the rail.

"The force of 53,400 pounds is therefore applied to the crank pin, pulling it forward, but at the same time exactly this pressure is applied to the back cylinder cover, and the cylinders bolted to the frame carries this same force back to the axle box and tends to push box, axle, and indeed the whole engine backward The center of the axle is, however, only 28 inches above the rail. We have therefore the same force, viz., 53,400 pounds, applied to two levers of different lengths, one 40 inches long and the other 28; that is in the proportion of 10 to 7 The moment of the force at the crank pin, about the instantaneous of the force at the crain κ pin, about the instantaneous fullerum at the rail, is $53,400 \times 40 = 2,136,000$, and that at the axie is $53,400 \times 28 = 1,495,200$. The difference between these two moments is 640,800, in favor of the crank pin, and the engine moves

"On the back stroke the pressure on the piston and front cylinder cover is 53,400 pounds, and the moment of the force at the crank pin when on the lower quarter or 16 inches above the rail, is 854,400 moment of the force at the axle-center about the fulcrum on the rail, is 1,495,200. The thrusts on the orum on the rail, is 1,3°0,2001 Inc thrusts on the pin tend to drive the pin, wheel and engine backward, while the pressure on the front cylinder-cover, frame and axie, tends to drive the engine ahead. The difference between these two moments is 640.800; the same as in the previous case, and the engine continues to move shead

"On the back stroke the steam practically pulls the cylinder over the piston a distance of 2 feet, but the half circumference of the wheel is 7.33 feet, which is the distance the engine moves shead. On the forward stroke the piston is pushed through the cylinder 2 feet, while the engine moves shead 7.33

"To picture the push of the piston as it acts on the crank pin when below the center line of the axle, let us suppose we have an ordinary wheelbarrow with that the two legs of the barrow have small wheels so that the whole can easily be pulled along without anyone touching the handles. Now tie a string to vertical spoke on the lower half of the wi This is the one standing between the hub and the If this string leading forward from barrow be pulled, one would almost expect that the sel would move in the direction of the hands of a clock, and that the wheelbarrow would move back ward, and one would almost expect the spoke with the string attached would swing to the left

"As a matter of fact, neither wheel nor spoke move in this way, and anyone who cares to prove it can easily do so with a toy cart or other small vehicle If there is sufficient weight on the wheelbarrow to prevent slipping, a pull straight ahead on the string attached near the rim to the vertical spoke will actually produce a motion of the wheel in a counter-clockwise direction, and the pull on the string becomes strong in consequence, and the wheelbarrow will roll forward toward the man who is pulling on the string. action is exactly opposite what occurs on the engine Similar action to what takes place on an engine would be secured if the man got on the wheelbarrow and applied force to the vertical spoke below the center

The Story of the Cadillac

This story not only describes the many superior features of the Cadillac car but it gives much information which the automobile buyer wants to know and which will be of advantage to him no matter what car he may favor

In the FIELD OF MOTOR CARS, the Cadillac stands pre-eminent as representing the most advanced de-definition of the most care the care that th The Cadillac has the advantage of being manufactured in the plant whose experience, organisation, equipment, facilities and methods are without parallel in the ludustry

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The expense for tool maintenance alone has exceeded \$100,000 in a single year.

The expense for tool maintenance alone has exceeded \$150,000 in a slage year. The second of the seco

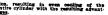
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CADILLAC "THIRTY" MOTOR

CADILLAU "TRIETY" MOTOR
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How CADILLAC Cylinders are Tested for



NOONTIME AT THE MAIN PLANT

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THE STORY OF THE CADILLAC .-- Continued

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Note the five large substantial bearings Also Showing Oil Wells and Distributing Troughs

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System find gauges which more being several to the several s



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CADILLAC REAR SPRING SUSPENSION

The rear suspension is of the three-quartor platform type, a type which is constort, but which makers of cheaply constructed cars cannot afford to use and which few have sufficient knowledge to apply correctly. Like most other fatures, this is one which the Cadiliac

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The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

The "Valveless" Gas Engine By Hayner H. Gordon of the United States Patent Office

To write an article, dealing almost en tirely with the valves of some of the newer types of internal combustion mo tors, and then to give it the title of this article, may seem not only startling, but contradictory. This incongruity, however, between title and subject matter disappears when the statement is made that every internal-combustion engine of the four-cycle type, must have valves in order to make it run, a statement which will perhaps be better understood, when the principle of operation of the modern four-cycle gas engine is explained.

In such an engine, the piston makes two downstrokes, and two upstrokes, to complete one cycle of operations. In the comprete one cycle of operations. In the first stroke down, a vacuum is produced in the cylinder, and the charge of com-bustible gas is drawn in. On the up-stroke, this charge is compressed to about sixty pounds per square inch.

When the piston reaches the top of its stroke, the charge is ignited by some such means as an electric spark, and the piston is then driven down on its working stroke. On the next upstroke, the exhaust valve is open, and the products of combustion are exhausted. It is easily seen that some means must be provided to govern the inlet and exhaust ports at the proper time, in order that the functions of the cycle may take place in proper order and sequence. By definition a valve is any device for controlling a passage. The engine must therefore pos-

sess valves in order to be operative.

Valves may generally be divided into

In the first place, there are those which operate by lifting from a seat with which they make a gas-tight joint The ordinary poppet-valve is the best example of this type In the second place, there are e valves which by the sliding of one part over another bring two parts into register, and form a passage. As this sliding motion may be either rotary or reciprocatory, both rotary and recipro catory valves belong to this second

Un to the present time, it has been nearly a general practice to equip the or dinary four-cycle motor—such as is used in automobiles with valves of the pop pet type These valves are nominally held on their seats by springs, being lifted up by cams. The last few years however, have witnessed the adaptation of valves of the second class to the fourcycle motors, and it is this type of valve which applied to the internal combustion engine, produces the so-called "valve-less gas engine"

term "valveless" appears to have its origin in the fact that, engines with valves of the second class, do away with all the noise attendant upon the use poppet valves with their springs and tap-A person seeing one of these en gines run for the first time would gen erally come to the conclusion that engine produces the so-called "valveless

The application of sliding and rotary valves to the gas engine is not new. In fact, the first gas engine to attain any marked degree of commercial success sed slide-valves for controlling both in let and exhaust. This was the Lendin Engine, patented in France in 1860, and in the United States in 1861. One of the first rotary valves shown in connection with an internal combustion engine, ap-

are in a United States Patent, granted and another part is exposed to the cold travel in opposite dis

Reciprocating slide valves, as applied to the internal combustion motor, may be divided into two classes. First, those which are of the ordinary piston or slide valve type. Secondly, those which are of the sleeve type, and which either slide on the interior of the cylinders, between the cylinder walls and piston, or else sur-round the water jacket of the cylinder, shows a modern slide valve (invented by Mann), which is representative of the first class. The valve, which is of the does not need much travel to give a large piston type, made tight by the packing area of opening. It will be seen that this

ncoming charge.
Fig. 2 shows the Moore sliding-sleeve

valve, located between the piston and cylinder walls. The sliding-sleeve contains one port 10, which registers alter nately with inlet and exhaust ports 8 and of the jacket, as shown in Fig. 4, there The loss through friction in this type of valve, is not as great as appearances would indicate. The friction of the piston on the valve, is no greater than the and reciprocate on the outside Fig. 1 friction of the piston on the walls of the cylinder; and the valve ports may made so large laterally, that the valve ring 10, reciprocates up and down in the valve also has a type of valve-gear which valve cylinders, opening first the inlet gives the valve a quick opening of ports.

How the "valveless" gas engine developed.

then the exhaust. The valve-gear of this The disk 12 carries a nin 14, which open valve is an interesting adaptation of this ates in a slot in the valve-operating lever radical type of valve-gear to the gas en- pivoted at 15, thus giving the valve an gine, for it combines the two reciprocating motions produced by the eccentrics 15 the ports, and moving the sleeve slowly speed of the other, so that the two mo-tions are alternately added and subtracted during the cycle of operations. This gives a very quick opening and closing of the inlet and exhaust ports, while from the time the inlet is closed to the time the exhaust is opened, the valve remains almost stationary. In some cases separ ate slide-valves are used for the inle and exhaust passage. All successful slide-valves of this class, as applied to gas-engines, are now of this piston type This is due to the fact that the piston valve is much easier to keep tight than the plain surface valve in a gas engine in which the range of working tempera ture is much greater than in the steam engine. This large range of temperature tends to produce unequal expansion of the different parts of the valve, particu-

accelerated motion during the opening of One of these rotates at twice the during the compression and expansion

Figs. 3 and 4 show types of sleev valves inside and outside of the cylinder respectively. In each case it will be noticed, that these valves are of a double type. Fig. 3 is the new Knight or Daimies The advantages of the double sleeve type over the single-sleeve type lies in obtaining a quick port open and closing, with a slow motion of the eeves. In each of the engishown in Figs. 2 and 4, the sleeves are moved by ordinary eccentries. The in crease in friction of the double-sleeve type over the single-sleeve type, is not so great as one would imagine. In fact, this type of valve is claimed by some to have less frictional loss, than the former. This is due to the fact that the two sleeves are generally traveling together

ports open and close also tends to away with frictional losse s. for the travel of the separate sleeves and their speed do not have to be so great as in the single type. In the case of the sleeves outside is, of course, a greater frictional loss than is the type of engine shown in Fig. 3. In the two sleeves upon each other, and of each sleeve upon the casing, as well as the piston in the cylinder. While in Fig. 3 the friction of the piston and the inner eleeve is no greater than the fricti the piston in the cylinder as shown in

Rotary valves may be classified in the first have the ordinary rotary valves an d to an internal combustion engine. This form is shown in Fig. 5. This type of valve would give trouble from unequal expansion owing to the cool charge ing through the one portion of the valve, while the hot exhaust gases pass through another portion. A better form of engine in which rotary valves of this type are used, is one in which the valves are made of conical form and spring press d upon their seats, separate valves being used for the inlet and exhaust.

Fig. 6 shows a rotating valve of the sleeves 27 and 28 are driven by bevel gears tion is much greater than in the case of the single-sleeve reciprocating valve. But at high speeds the effect of inertia is not vident in the case of a rotating valve while it causes loss in the ca reciprocating valve. The use of the dou ble concentric sleeve-valve is not limited to the reciprocating type.

Fig. 7 shows an engine employing a double sleeve valve. In this case the sleeves 27 and 28 are driven by bevel gears 31 and 32, so as to rotate in op-posite directions. We may thus cut down the speed of our valve travel, and it the same time maintain a quick port control. The use of multiported aleeown the speed of travel so that the frictional loss is correspondingly decreased We may also copy from the reciprocating valve engine, and place our rotating sleeve outside of the water jacket. This is shown in Fig. 8, in which the rotary sleeve, A, controls the inlet ports, B4, and the exhaust port, B5.

In giving a summation of the advan-

disadvantages of the above types of valves, it is difficult to know just what limitations should be given. The use of a given type of valve with any engine, depends not only upon the de-sign of that particular engine, but also upon the character of service demanded from the engine. An aeroplane engine should differ in design from an automotile engine of the same size. ciency of a valve depends upon its speed of opening and closing—its waste of engine power by friction-and in the ca ating valve, the effect of inertia upon the balance of the engi The factor of noise in operation is also to be considered

Both reciprocating and rotating valve take more power to drive than the well known poppet valve. However, smooth closing, and the ability to remain in tune, give these valves advantages over poppet valve. It is true that both recating and rotary valves require o erable lubrication, but this draws larly where one part of the valve is est in the same direction, with the exception more than overcome by their increased posed to the hot exhaust gases, which of the time when the perts are opening spicions; over the poppet valve. The re-have a temperature of about 3,000 dec F., and closing. The Rut. Batt the aboves taking rating as grain, here's taking the

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tional loss than a reciprocating valve. To offiset this, however, we have the ability to give the valve better tuning, and a complete absence of inertia effects. Increta at high speed causes loss of power, and tonds to cause vibration through lack of balance. The latter can, of course, be overcome by proper methods of balancias.

valves, it is thought, will be limited to the small high speed engines. In the case of the large low speed engines we can obtain quick port control by means of the simple poppet valve. In large engines also the valves have to be water-cooled. In the smaller engines, the internal sleeves can be made thin enough to have no maderial effect upon the cooling of the engine. In the case of large engines, however, the added thickness of these sleeves necessary to carry their own weight, would doubtless give trouble in cooling, and the unequal expansion, caused by the heating of those large valves, might cause them to bind.

There is no comparison between the noise of an engine using either reciprocating or rotary valves and an engine having ordinary poppet valves. The engine using the reciprocating or rotary valves, when well bakanced, runs as smoothly and silently as an inclosed steam engine of the same size. In closing this brief review of the art

In closing this brief review of the art of reciprocating and rotary side valves, as applied to the internal combustion engines, it might be stated that, while the number of types and forms of valves appear to be nearly complete, yet their slow adoption and appearance in practical usage, show the lack of efficiency and completeness in detail, which after all, are the essential elements which mark the line between success and failure in invention.

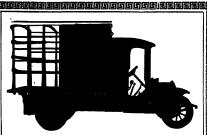
Oddities Encountered in the Patent Office

DOPULAR supersition to the contrary, the average inventor is far from being a freak. We may talk as we will about the eccentricities of genius, but beyond a very small percentage of instances, gonius is not eccentric. Eccentric individuals are encountered in every line of human endeavor, and to saddle the term happassard upon a man just because he happens to be an inventor is an injustice which every fair-minded person must deplore. Sifted down through its various applications, the word "eccentric" appears to mean just one thing, and that is "individuality" in the property of the superson in the contraction of the superson in the

When it is remembered that the telegraph was invented by a man who was laughed at and regarded as a harmless "freak," and that every inventor and discoverer from the time of Christopher Columbus down to date has been encouraged by the smeers and doubts of his fellows, the inventor who is pegging along at his bench and developing his brain children, need have no misgrings because someone sails him a "freak,"

Naturally ignorance is responsible for a good deal of so-called cocentricity. Man's allotted time on earth is limited. There must be things that he eannot know. A man who is ignorant of court procedure and legal forms is not hoosed at by lawyars; nor do doctors make sargustic remarks about people who have not mastered a knowledge of therapeutics. Because he does not know hard you know, is no indication that a man does not know anything. There is no form of endeavor that is so exacting and requires such concentrated effort as the investor's hope hours and warstoom application is the inventor's lot; he totis that the world may be benefited. Like Edison, he may literally "ealighten the earth" by the efforts.

Means of maker of With the utmost patience and considera-



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dreds of inventors every day. They write in from all parts of the globe saking to get that protection for their inventions which is the reward of their painful and arduous work. Some of these inventors are necessarily ignorant of what to do. They have been occupied in what is to something far more important than a study of the Patent Laws. The Rules of Practice they have probably never heard of. To them the great thing has been to perfect the invention, and let the Patent Office do the rest

All sorts and conditions of people turn their thoughts toward invention. A dis-covery which may seem trifling may net the discoverer many dollars and place him beyond the reach of want. It is no torious that every adult person in New York is writing a play. To test the re-port, a man asked the conductor of a Broadway car how his play was getting and the conductor instantly replied: "I have finished all but the fourth act." A successful play makes its author rich over night It is the same with a sucinvention, and the question: "How is your invention coming on?" might elicit a response like that of the street car conductor.

It would certainly seem from the vast business transacted by the United States Patent Office that the rewards for sucessful inventions are peculiarly attractive to mankind. Out of the huge cor respondence which the Patent Office re ceives, a small collection has here been of those which may be termed "oddities" in the absence of a more descriptive years, a lifetime maybe, of patient toil term. Some of these are quoted, not to and worrying over perplexing problems. prove that inventors are as a class en-titled to the designation of "eccentric," but to show that genius frequently fails to find time to acquaint itself with some of the conditions which exist around it. No outsider is supposed to know by heart the ramifications of the Patent Office, and it may be said in passing that the clerks in the Patent Office cheerfully answer all letters and do their best to guide the inquiring minds into the necessary chan

Like the country editor who announced "It is our position not to publish news from whom we do not know who sent it" and "to insure insertions you must sign your name somewhere in the envelope so that we may know who to call upon if they attempt to shoot us," the Patent Office would be giad to have correspondents sign their names. The innocent emission of this important detail ometimes lays the office open to sus picion of neglect. In about a week an rate letter is received and the office has glance at the other visitor, who perpe to grin and bear the abuse. To enter into a lengthy explanation would only waste time, and time is a precious commodity in the Patent Office.

A frequent pest is the individual who asks for copies of patents, but fails to transmit the money to pay for them. He is politely requested to send the amount, and his next letter reads something like this: "Here is the price of the three patents I ordered. Please send the patents, etc," and the office has to dig up the original letter, which may be already filed away, in order to find out just which patents were wanted.

Some time ago a hopeful inventor asked: "Has there ever been any water-gage patented? If so, is it like mine?" That was all. It never occurred to him to describe what his water-gage was like. In view of the fact that there are more than five hundred water-gages patented up to date, the task of the office can be readily imagined. Of course the man may have an entirely new device and one which is patentable. Like the young Washington. which is paramach. Like the young washing the lady who revised to let the telegraph. The repeal of the Caveat Law has been operator read the message size wanted a great hoon to orthography. A young trummitted to her swetthers, he is artist landy who assures correspondence in the to trust the Patent Olice and a patent Patent Olice compiled a list of all joint attorney with the knowledge of his in-them of the compiled a list of all joint the providing of the inlady who refused to let the telegraph

Office and with one's patent attorney resential as it to with easy having physician. There is a pathetic side pourse, to the incurse of the investor lives in feer and trembling lest his gr himself surrounded by spice and thinks the Patent Office is merely waiting to get hold of the invention to "tip it off" to eryptic letters in which his referen to his invention are veiled eautiou

"I want to know," writes one time soul, "whether I can have the sole right to my patent," fearing perhaps that the Patent Office will want to assume at least one-half ownership if the investion turns out to be practical. He does not know that only once in the century of the existence of the Patent Office were the ideas of an inventor stolen by a Patent Office employee, and that the employee in question spent three years in the penitentiar; as a result. The strictest scorecy prevails in the Patent Office as to pending applications, and not even a man's broth er, or his partner in business, much less an outsider, can get information without the inventor's written permission.

The man with the perpetual metion machine is not so frequent as of yore, but he crops up now and then. At one time the Patent Office had to make it an ironclad rule not to consider applications for patents on devices of this kind, unless companied by an operative (!) model. Each case, however, is a study in itself. It eloquently bespeaks months, perhaps Each man is sure he has at last achieved perpetual motion. "I know." writes one of these, "that countless machines have been offered for patent, but mine REALLY IS perpetual motion at last!" to come to Washington and demonstrate his invention, but the office has to gently, but firmly, decline the offer.

A Washington patent attorney reis

an incident regarding perpetual motion that came to his knowledge. He returned from luncheou one day to find two gen tlemen waiting in his office. One of them had a huge roll of blue prints, so large that the attorney had to invite them into an unused room, where the plans could be spread out more comfortably. The vis itor, who was the inventor, was most eloquent. He had, he explained, an invention of a locomotive which would run by compressed air, the compressed air to

be generated inside the engine itself.
The attorney who had listened natis ly to these descriptions, gave a quick trated a very decided wink. This was sufficient for the attorney, who, after some difficulty, got rid of the callers. He promised to look at the plans again at his leisure, and gravely accepted the fee of twenty-five cents which the "inventor" handed him. He dared not decline it, as he realised then that his visitor mentally unbalanced, and that the refusal of the coin might be the signal for an outburst.

the attorney looked up his files and found that the call had been made by appointment. The man with the perpetual com pressed-air engine had written for an appointment, and the attorney scenting client had invited him to call and bring his plans. There had been no intimation in the correspondence that the man's device was of the character disclosed. The attorney had thus, unwittingly, courted a call from an inmate of St. Elizabeti the great asglum for the insane which hes across the Anacostia River from

ention.

Absolute frankness with the Patent "covent." The list is as follows:



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cavetti; caviat; caviet; cavat; caveys; cavet; cavaet; cavit; ekivet; kevats; kabiat and accadia. Luckily the law no longer permits applicants to file caveats, or it is feared the list would have been greatly swollen

An astonishing announcement was re cently received, which read: "There is a man in my town who has invented a medicine that will cure an ailment for which there is great demand." Another correspondent is still more vague. He writes:

"If not asking too much, would you kindly supply me with information concerning patents I would like to take out a patent on a machine and would also like to find out if someone else has a patent on it."

The statement of what sort of a ma chine he had invented did not seen necessary to this individual Of course the Patent Office told him how to go about getting the information he wanted, but the office does not make searches through the granted patents on behalf of inventors. This work should be intrusted to an authorized attorney. It is obvious that if the office once started to do is, it would speedily be swamped, inundated and engulfed by requests, and e clerical force would soon be doing nothing else except make preliminary

It is by no means unusual to receive a request for a "list of all patents granted," nor is it infrequent that some individual wants actual copies of all the patents granted. No doubt the latter re quest could be complied with, if the applicant were prepared to pay for them a the regular rate, but as nearly one million patents have been issued by United States, he would probably balk at paying the necessary fifty thousand dollars, even if Uncle Sam would undertake the carriage postage free.

During the past year a letter was re-ceived from a man who had invented a wrestling method The half-Nelson, the strangle, and the cross-buttock were all obsolete, and he wanted to have his new method patented, he said.

"I suppose you read the accounts of Jeffries and Johnson," he wrote "the part of the trick is that there is four holds in wrestling the contestant does not attempt to hold on the state of the trick is that the state of the trick is the state of the trick is the state of the trick is the state of the sta

Alas! this information came too late. One inventor writes that he offered Brazil a forty per cent better navy than it now has, but does not state why Brazil refused the offer. Another tells the Com-missioner of Patents to fortify the Penama Canal as much as he can. Still another avers that his invention (he does not state what it is) cannot be manufactured in the North "because black jack and cotton wood is the best to He evidently has no faith in the facilities for transporting lumber. tactities for transporting tumer. The discovere of a recipe for making pump-kin wine, claims that "it is better than using grapes." This statement might pens for what it is worth, or at least as a matter of personal taste, had not the inventor made the additional claim that "pumpkin wine is a tape-worm cure, be

The story of the hoax perpetrated by the mechanic who sent his green apprentice to borrow a left-hand monkey wrenci was evidently not familiar to the wouldbe inventor who recited with great clab n of detail that he had devised a "left-handed wheel-barrow" and wanted it patented right away.

The inventor of a turbine type of en sine is all condescension when he re-marks on possons: "I am perfectly aware there are some fast 'freak' beats on pa-per. Some of mine went a little further than paper." "Could heat," inquires one tetter writer, "be used as light, held susrended, as in phosphorus or radium? I

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"Do I understand that the POSTAL LIFE actually saves to me the usual commissions paid to agents of other companies". We are constantly replying that such understanding is correct; the POSTAL does this very thing; the Company saves the first year's commission to the agent and his rricual commission in subsequent years, credits it at once, and pays it whenever the policyholder wants it.

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"Do so many actually answer your."

interested in lite-insurance.

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What pleases the inquirer is that
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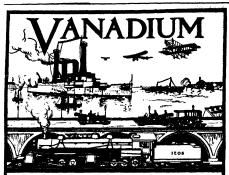


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Automobile Supply Manufacturing Company 220 Tanffe Pince, near De Kalb Ave., Brooklyn, New York own climate. The thing seems too big to complete," a conclusion that cannot be disputed.

"An airship propelled by the explosion of giant firecrackers" is the fancy of one inventor. This may be termed a slight modification of the internal combustion ngine, but the means of locomotion thus described would form rather a weight; CRTEO.

A misunderstanding with regard to th citation of references is evidently the cause of the following outburst:

"Please tell why I have paid in full up to the grant of patent and then your examiner tells my attorney that my invention is forty years old or dead? Such may so with the Dutch, but it don't go with the Irish."

The Official Patent Office Gasette, that highly dignified publication which contains a description of every patent grantd, comes in for a little sionally. The librarian of a public library omewhere in the West recently wrote: Please stop sending us the Patent Office Gasette. As only one man in the town ever read it, and he has committed sui cide, we have no further use for it." Not tanding this unfortunate fatality, the Gasette continues to flourish.

Odd letters are not always amusing. There are some that are pathetic like the one received from a poor man who claimed that he had perfected an improvement in grain separators. "Heretostraw. By my invention, I seek to sep-arate the straw from the grain," and he ent on to state that he had kept his family in poverty while developing this somewhat extraordinary conception

Patent Office correspondence. There is one persistent person who does not heed the admonitions of the office and its explanations as to how to prepare and file his application properly, but who makes on an average of once every two weeks an application written informally on a piece of fool's cap, and begins: "I, -- most humbly pray for protection of the following inventions, and I most solemnly swear, and this in the

The religious element, too, enters in the

name of God the Father, God the Son and God the Holy Ghost, that I am their ole inventor and influenced by no one."

Another devout inventor writes: "My

Another devout inventor writes: "My help comes from the Lord. He has given me this talent, and I want to make good patents were given out.

This is the Patent Office," replied the in my mind. You know the Lord gave clerk addressed. "What can we do for some talents to some people. The one that buried his he took from him and gave to the one that had the most, so I want to multiply mine."

A novel argument was recently adnced by an inventor in behalf of his disinclination to take the necessary oath, required by the Patent Office, to show that he was the original inventor of the device for which he applied for patent. He had no objection to declaring himself the first inventor to the best of his knowledge and belief, but being opposed to the form of oath, which requires the deponent to swear and subscribe before a notary, he quoted the Bible as his authority.

Matthew v. 34 is his citation. "Bewear not at all," and also verse 37 of the same chapter, which reads: "But let your communications be Yea, Yea, or Nay, Nay; for whatsoever is more than these cometh of evil."

As a clincher to this argument against the Patent Office oath; the inventor in question contends that "a righteous per-son will not intentionally tall a lie underany circumstances; you may swear a liar forty times, and it would not make him

was the inventor of the divise is

genuine letters from its genuine latters from inventors, it may be interesting to quote a "latter letter which was written by a pulsat attorney which was written for a reas a joke on one of his associates. appears that this attenuar's sesociate de-voted his time mainly to the task of searching, and like many who appead a great deal of time among the re granted patents, whosever grapted patents, whosever anything was shown to him, he had a signing impre-sion that he had seen non-offing of the sort before. In fact he had seen so se on that hardly anything see new to him.

The patent attorney referred to took it this check to test the recollection of this chronic escriber. Accordingly he prepared a "take" semisusfeation and had it properly strained and placed on had it properly straughd and placed on his associate's desk. The letter was directed to the firm and proceeded to set forth that the writer had always been a student of languages, and in the pursuit of such studies he had discovere there was a mechanical relation between the different tongues, French, Germ English, Spanish, etc. In developing this discovery, the writer went on to say, he believed that he had invented a machine by means of which one language could be mechanically translated into another. He proposed, by means of slides or disks fore," he explained, "inventors have placed in the machine, to translate sought to separate the grain from the French into English, German into French, and so on, according to the po tion of the slide in the machine. For instance, one side of a slide being uppermost would translate French into English; reverse the slide and the English would be translated into French "inventor" desired to be informed whether the idea was new, and asked advice on having it patented.

The man well versel in the searching of patent records read the letter through or parent records read the sector through very carefully, turned to his partner, and said: "Here's something great! The trouble is it is not new; I remember hav-ing seen something like it before."

To return to the realm of abourd realities, it may be well to conclude this brief ation of Patent Office oddities with the following story:

be-whiskered individual wandered into the Commissioner's office one day and inquired if that was the place where

"Well," explained the visitor, "I'm a strangage in Washington. Just passin' through, and I thought I'd stop off and

get one of them patents, if you'll be so kind as to give me one."

Suppressing his instinction to smile, the clerk asked: "What is your invention, sir?

"Oh, I haven't invented anything, yit," returned the caller, stroking his luxurious beard meditatively, "but I thought it might be handy to have a patent ready

Notes for Inventors

The Air Propeller on Old Device.— The automobile with a propeller similar to that of a flying mac automobile engine and operating in the air to propel the automobile finds its prototype in two expired patents, one is-sued August 23nd, 1871, for a best designed to be propelled in the water by an air propeller driven by its engine, and the other lexued July 25th, 1676, for an automobile whose engine may be caused to drive either of two air propellers, one

forty times, and it would not make him tell the truth. You can't make a list of the lattice moving the ambanditie for tell the truth, neither can you make a Christian tail a lie. Am I not right?"

The writer was informed that his occupies against swearing were respected by the office and that he satisfies a make the work of the control of the contro

Typewriter



"HE reason lies in a series of ball-bearings, acting all the way from the keystroke to printed line, the gentlest tap of the key, the priever drops, the typebar springs the printing point, the carriage vances a step, each a ball-bearing ensition at minimum outlay of engr. The Capital Shifets hall-bearin, too—far lighter than seggedher, to the ball-bearing being practically tenders, are capable of closer adjustment, this permanent because without friction

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the staves, for making the hoops, for shaping the heads, for assembling the parts, and for finishing the barrels. In a new machine for pressing the hoops round casks by hydraulic pressure, mag-netised rings hold the hoops clear until the casks are raised to the exact position to receive the hoops. Another ingenious machine automatically chamfers the ends of the staves, cuts the grooves for the heads, saws them to an equal length, runs them through a printing machine, if they are to receive numbers, names or devices, and finally sends them through a drying oven

Safety Devices on Railroads,-As interesting to railroads and common riers generally, we note an order of the Interstate Commerce Commission of March 13th, 1911, extending the period within which the requirements of the act to supplement an act to promote the safety of employees and travelers, etc., shall be made effective. Thus the order extends the time governing the certain specified changes in freight train cars for five years from July 1st, 1911; for the changes in passenger train cars for three years from July 1st, 1911; for the changes in switching locomotives for one year from July 1st, 1911, and for the changes in locomotives other than switching locomotives for two years from July 1st, 1911, the order including certain modifications in the extensions re-lative to repairs or rebuilding of the cars as more definitely set out in the order in question

The Scientific American in the Patent Office. —A principal examiner of Patent Office, speaking in appreciation of the descriptions and illustrations of novel mechanical devices in the Scien-Tivic American, referred especially to their value to the Patent Office ex-aminers as citations against applications for patents. He suggests the advisa-bility of classifying clippings from the publication, which could be done to adantage in the classification division, and distributing the classified clippings to the appropriate examining divisions An attorney representing a well known aviator before the Patent Office, also in discussing the same subject, sucke of the importance of some citations made by the Patent Office of SCIENTIFIC AMERICAN illustrations in the field of aviation.

Commissioner Butterworth's Wit .-Ben Butterworth in his service in Con gress and as Commissioner of Patents as noted for a remarkably ready wit He was once opposed in a suit by an attorney, Tom Wood, and considerable bad feeling had developed between counsel. His client tells that on one oc sion when in conference with Mr. Butterworth, they heard Wood was dead and immediately Mr. Butterworth said "I would suggest an epitaph for him and it would read like this:

"Here lies the body of Tom Wood,

One wood within another.

But are doubtful of the other A Bit of Patent Office History .-- Prior to the Patent Office fire in 1877, which burned a large portion of the models then filed and destroyed the integrity of the collection, it was the custom of attorneys to make examinations of the models to determine the povelty of inventions submitted to them. The draw-ings were not then available to the public as now. On one occasion an attorney accompanied by the inventor found a model which fully met the inventor's idea. After this was determined and they had left the model case, the in-ventor who had lagged behind said to the attorney, "Well, they will never find that any more;" and when asked what that any more; and when asked what he had done, said, "I threw it on top of the case where they will never get it." Of course that made no difference, as the Patent Office examiner made his extion in the complete set of draw-



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THE W. M. SHARP CO.

Aeropiane Propellers
(Continued from page 149.)

propeller will be about 134 to 5 seet, while on a machine like the Wrighter, the revolations of the propeller would be accent 400 and the propeller would be accent 400 and the pitch about 11 feet. Now the friction and head resistance of the propeller blades passing through the airvary approximately as the square of the valocity. If the two propellers seeh had a diameter of 8 feet the mean velocity of the blades of the small pitch propeller through the air would be about 13 times as great as that of the large pitch propeller, and the loss of power resulting from friction and head resistance would be about eight times as great

For this reason it is desirable to make the pitch large and keep down the revolutions as compared with the speed. On the other hand, if the pitch is made too large the air is pushed around sidewise inatesd of being pushed to the rear, and as such motion of the air does not produce thrust excessive power is lost in that manner. With air propellers, as with marine propellers, it has been found that the best pitch is from 1.2 to 1.5 times the diameter.

There is also a practical disadvantage in making the pitch large, and this is that the starting thrust, before the sero-plane has got up to speed, is considerably less than with finer pitch procellers. Curiously enough, some experimenters and also makers of propellers conclude that because a stationary test of a propeller sives a large thrust per horse-power, the propeller is necessarily efficient when moving through the air. The cent contrary is opt to be true. In the stationary test, the propeller acts as a fan, and the more air it pushes to the rear the greater the thrust. When it is on an aeroplane are reversed, and what is wanted is a propeller to push the aeroplane ahead and not a fan to push the air to the rear. In other words, a good fan is not likely to be a good propeller.

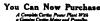
Material and Number of Blades.—With few exceptions aeropiane propellers are now made of wood, and usually with two blades only. On account of its lightness, ample strength, and ease of cutting to shape, wood is much more convenient material than metal. The use of wood has no doubt contributed largely to the almost universal use of but two blades, as they can be cut from a straight plece without introducing joints at the hub, as is necessary when more than two blades are used.

At first thought it might appear that if three or four blades are used 50 or 100 per cent more thrust would be obtained. In fact, in a recent annual publication dealing with aeronautics there is an article arguing that six blades and possibly more are best. Possibly this idea is due to considering that an air prepaller is only a windmill reversed. In the absence of reliable data on the subject til is probably safe to assume that in this respect the facts are likely to be the same as found for marine propellers With them it has been found that for efficiency the fewer the blades the better, and that two blades are best. It has also been found that for efficiency the fewer the blades the better, and that two blades are best. It has also been found that for the latter, when running at the same spied through the water, and with the same number of revolutions, was about 20 per cent only, while the increase in power required was about 28 per cent only, while the increase in power required was about 28 per cent.

cent only, while the increase in power required was shoult 28 per cent before The reason why three or four blades. The reason why three or groupellers is because they are usually restricted in diameter by the depth of water over the tips and the size of the vessel, and it is necessary to have more than two blades in order to get the desired threat. Another reason is that two blades are likely to produce more wirestlon.

to produce more vibration. With the servjoints as to size are not so great, and vibration due to size are not so great, and vibration due to moter or propellers does not yet seem to have caused any segsiderable inconvenience. Both from a presented standpoint and for efficiency the swo-bleated





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Rules Governing the Competit for the \$15,000 Flying Ma---chine Prize Offered by Mr. Edwin Gould

1. A price of \$15,000 has been offered by Mr. Edwin Gould for the most per-fect and practicable heavierthan-sir fly-ing machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate meters and propellers), so connected that meters and propellers) be compared inde-pendently, or that they may be used to-sether.

CONDITIONS OF ENTRY.

CONDITIONS OF ENTRY.

2. Competitors for the prise must file with the Contest Committee complete drawings and specifications of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Buch entry should be addressed to the Contest Committee of the Gould-Schwitziec American Priss, 361 Broadway, New York city. Each contestant, in formally entering his matching must be considered to the contest of the con

fuel-carrying capacity, and the nature of its steering and controlling devices.

3. Entries must be received at the of-fice of the Scientific America's nor be-fore June 1st, 1911. Contests will take place July 4th, 1911, and following days.

At least two machines must be entered in the contest or the prize will not be awarded.

CONTEST COMMITTEE.

4. The committee will consist of a representative of the SCIENTIFIC AMERICAN, a representative of the Aero Club of can, a representative of the Aero Club of America, and the representative of some technical institute This committee shall pass upon the practicability and ef-ficiency of all the machines entered in competition, and they shall also act as judges in determining which machine has made the best flights and compiled with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

CONDITIONS OF THE TEST

5. Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and that he is able to drive each engine and proposler independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be al-lowed to compete unless it can fulfill these requirements to the satisfaction of the Contest Committee. The prize shall not be awarded unless the competitor can not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight and the second of the power plants disconnected; also he must drive his engines during said flight and the second of the motion can probably be used to prove such performance.

In the judging of the performances of In the judging or the performances of the various machines, the questions of stability, ease of control, and safety will also be taken into consideration by the judges. The machine best fulfilling these

stability, same of control stars and the property of the control stars and the control s

field of trial.

9. The place of holding the trial shall be determined by the Contest Committee, and the location of such place of trial shall be announced on or about June 1st.





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several brisk young men in France, and in particular by the famous seronaut. Santos-Dumoni, who, without special preliminary icainois in aviation, and while others were cautiously studying made methods, suddenly boiled fitto the air on a crude biplane, and navigated over the heads of his autolished friends by sheer audacity and swkwardness, but ally seconded by his marvelous Antoin-addy seconded by his marvelous Antoin-

ette motor
One naturally inquires why Mr.
Chanute did not achieve that easy renown. The reason was simply that when
a light motor was first available he had
passed three score and ten. He was now
too old to ride and experimental aeroplane and too scrupulous to invite any
completed his important ploneer work
still was serencied watching the younger
ompleted his important ploneer work
still was serencied watching the younger A more passed three too old to ride an appared on pinne and too scrupulous to make some one else to take such a risk. He han one else to take such a risk. He han completed his important ploneer work and was serensly watching the younger plant in the property of the series one by one, then by scores, to complete the risk of the series one by one, then by scores, to comply the fruits of his labor and that of his hand the risk has been been and the robben of automatic starting his way for find success. He way for find success the way for find success the way for find success. He way for find success the way for find the

Before his death on Thanksqiving Day, 1910, Mr. Channte had seen his most sanguine dreams more than realised. Flyers were traveling from city to city at more than railway speed; sweeping over vast stretches of water and unknown territory, guided through fog and tempest by the simple mariners' compass; soaring like eagles above the rain clouds and in regions while with frost; racing over the Alps; contrading in great tournament; manuelvering with great tournaments; maneuvering with armies as a serious adjunct of the great armies as a serious adjunct of the great military establishments of the world. He did not live to see an aeropiane rise in-differently from land or water, nor to see a dozen passengers in one machine, nor an aviator of less than a year's train-ing fy without pause from London to Paris, through fair and foul weather, at Paris, through fair and four weather, at more than a mile per minute; but these things he could easily anticipate, and much more that still remains to be acbedellemos

compilence.

One favorite dream of his that still romains unrealized is the achievement of soaring flight. He was convinced that of soaring flight. He was convinced that the great vultures, guils and powerful birds of prey can in favorable weather ride the wind for hours without wins-beat or the expenditure of propulsive power ladeed, one incentive to hig glid-ing experiments was the hope to pro-mote the art of human soaring. And one most the art of human soaring. And one sastire, two years before his death, demonstrated the feasibility of soaring in a wind having an upward trend of three to four feet per second. He mote the art of human soaring. And one of his latest papers published in Aeronautica, two years before his death, demonstrated the feasibility of soaring in a wind having an upward trend of laland, has brought to this country the large as a sport in those localities favoring as a sport in the sea, hoping that they might eventually acquire something of the art of the sea, hoping that they might eventually acquire something of the art of the condor and the albatross. Ferhape ere long that dream, too, may be realized, the first of which was made by the Godmes condor and the albatross. Ferhape are long that dream, too, may be realized, the first of which was made by the Godmes condor and the albatross. Ferhape are long that dream, too may be realized, the first of which was made by the Godmes and the albatross. Ferhape are long that dream, too may be realized, the first of which was made by the Godmes and the second of the sport of the sea of the sport of the sea of the sport of the condornation of the sea of the sport of the sp

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(Contented years of the Contented years)

Mr. Chanute forwarded & quantity of varieties and the contented interfactor, visited has ensure the contented interfactor, visited has ensure within which the contented interfactor, visited has ensure within which the contented interfactor at Edity Have. North Chamaties and percentally cuttivate at Edity Have. North Chamaties and percentally cuttivate at Contented in the process of the contented into the december of the contented into the december of the contented into the december of the pleaser actually and the contented into the cont

the Antoinette patterd, for example, the Antoinette patterd, for example, could power a Chanute biplane and fly in his work, no very adequate or formal fair weather. This was well shown by recognition of his character and important labors in seromatic was made in particular by the famous seromaut, by his countrymes fluring his lifetime. Santo-Dimonit, who, without special pre-fine particular in a state of the particular products of the particular products and the product of the particular products and the product of the particular products and the product of the products and the product of the products and the products are considered and the products are considered and the products and the products are products and the products are products and the products and the products are products are products and the products are products are p gan to assume great value in the ge estimation. It is to be hoped, how that ere long his countrymen will lish a suitable memorial of his long de-votion and fine achievements in a sci-ence of such fascinating interest and un-told possibilities for humanity.

Automatic Stability of Aeroplanes (Continued from page 471.)

whereby the difference in the pressure of the atmosphere on the root of a box causes a movement not unlike that of the disphragm of an aneroid barometer, which is communicated by a delicate mechanism to the motor keeps the atti-tude practically constant. On December 31st, 1896, E. J Penning-ton patented in England a still more in-moter and worm gear drive of the eleva-tion rudder is controlled by means of the index finger of a barometer so as to maintain the aerial vessel at a pre-

to maintain the aerial vessel at a pre-determined altitude. In addition the motor and worm gear operating the rud-der for direction is controlled by the der for direction is controlled by the movement of a compass needle which, by means of electric contacts, causes the motor to turn the rudder so as to keep the machine on a steady course. Such devices are highly ingenious, but their practical worth is still to be de-termined

Earle Ovington's Blériot













Mr. Ovington has fitted his machine with every useful accessory that he could lay his hands on in the Paris aviation chops. As he sits in the machine, in front of him he has a map holder so arrecest of him be has a map holder so arranged that by simply turning a knurled with an exceptionally light and small whose he can move the map as the country passes under him. Similar map hat country received the second of the control of the cont this country, the instrument recorded the rise and fall of the stern of the boat without difficulty. Between the aviator's legs but the floor is a universally hung compass of the glycerine floating type. which Blériot has four one for aeroplane use. found the only reliable

Aeronautic Wireless Telegraphy By Percy G. B. Morriso

THAT wireless telegraphy is the com-THAT wireless telegraphy is the complement of the military scropians
can no longer be doubted, and since the
successful demonstration of the transmission of messages by this means at
Sheephead Bay in 1910 from a Curtiss
biplans to a field station, both military
and aviation experts have been turning
their attention to the possibilities of restructure. The chief problem that has
confronted those interested in this work
has been in providing a suitable antenna. confronted those interested in this work has been in providing a suitable antenna for the aeropiane end of the circuit, and the astisfactory disposal of the same. In the attempts made on the Pacific Coast last year the army officers experimenting obtained their best results in transmitting by using a hanging antenna. The experimenters in this case took aloft a 204-too tool of fine copper wire which was let out and allowed to dangle toward the ground as soon as sufficient altitude was attained. When the experiments were completed, or when the aviator was about to return to earth, the wire was about to return to earth, the wire was

Marie Committee Committee

in the beginning of March, 1911, the wires have redder edges. The wires have redder edges also special beginning of the withing are also special redder, which was the wind the wires cooperated with Mr. J. A. D. Modern and the special property of the making and the special property of the special property of the making and the special property of the speci

or from the intense rush of air, a tem-porary head-dress was improvised out of a face towel, handkerchiefs, and cotton wadding, the whole being tightly bound wadding, the whole being tightly bound around the head over the telephone re-ceivers with tire tape. The detector and tuning apparatus was carried on the kness of the operator, who experienced absolutely no difficulty in adjusting with one hand and in writing with the

Immediately the machine left Immediately the machine left the ground, signals from Key West Naval Station became distinctly audible through the telephones, as did the signals from the station at Havana, 300 miles distant, in answor to Key West. At a height of about 1,000 feet, signals of an extremely high tone were heard, but the proposed of wholey recesses, was helded. purport of whatever message was being sent was lost owing to the "jamb" from Key West. From the tone of these sig-nals it is thought that they probably proceeded from a Fossenden set on some proceeded from a Fossenden set on some United Fruit boat, the nearest of these, working at that time, being in the vicin-ity of Panama When an altitude of about 1,500 feet was resched other high-frequency signals were heard which the attempts made on the Pecific Count large that the tempts are not considered their best results in transmit politised their best results in transmit political politic

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acknowledged, but little is known of the details of construction or the many features which make them the standard of the this reason we would like to send "The Revolver," it contains much interesting and useful information of value



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Section in Food

Saccharin in Foogl
A The request of the Secretary of Agtriculture, the Referree Board of Opinsuiting Scientific Experts has conducted
an investigation as to the effect on
health of the use of saccharin. The investigation has been concluded, and the
Referree Bourd-reports hought and the
Referree Bourd-reports hought in quantities over three-tenths of a graume per
day is liable to impair (figsettion; and uttes over three-tenths of a gramme per day is liable to impair digestion; and that the addition of saccharin as a sub-stitute for control of the control o that the addition of saccharin as a sub-stitute for cane sugar or other forms of sugar reduces the food value of the sweetened product and hence lowers its quality.

Saccharin has been used as a subs Saccharin has been used as a substi-tute for sugar in over thirty classes of foods in which sugar is commonly recog-nized as a normal and valuable ingredi-ent. If the use of saccharin be continued it is evident that amounts of saccharin may readily be consumed which will, through continual use, produce digestive disturbances. In every food in which saccharin is used, some other weeks that saccharin is used, some other weeks that on be substituted, and there is not even a present that saccharin is a necessity in a pretense that saccharin is a necessity in the manufacture of food products. Under the food and drugs act articles of food are adulterated if they contain added poisonous or other added deleterious inpoisonous or other added deleterious in-gredients which may render them injuri-ous to health Articles of food are also adulterated within the meaning of the act, if substances have been mixed and packed with the foods so as to reduce or lower or injuriously affect their quality or strength. The findings of the Referes Board about the sacchard in cold and deleterious ingredient as is contemplated by the act, and also that the substitution of saccharin for sugar in foods reduces of saccharin for sugar in foods reduced and lowers their quality.

The Secretary of Agriculture, there-fore, will regard as adulterated under the food and drugs act foods containing accelarin which, on and after July 1st, 1811, are manufactured or offered for sule in the District of Columbia or the sate in the District of Columbia or the Territories, or shipped in interstate or foreign commerce, or offered for im-portation into the United States.

A Dictionary of Aeronautics

THE Technical Words Committee, which has been constituted by the Acronautical Society of Great Britain for the purpose of standardizing aeronautical terminology, has just issued the

following preliminary report:
In view of the somewhat confused state of aeronautical terminology at present prevailing a Technical Words Com-mittee was appointed by the Aeronautical Society of Great Britain to draft a list of Society of Great Britain to draft a list of technical terms relating to seronautics, and to define their meaning. The work of the committee has proceeded along systematic lines, and has already re-sulted in the compliation of a glossary of the more general terms in use. It was decided, therefore, to issue this list forth with in the form of a preliminary report, as it fairly well covers the technical vo-cabulary involved in the ordinary course of aeronautical work. Since uniformity in this matter is essential, it is hoped that all writers on aeronautical subjects will generously sink individualism where will generously sink individualism where necessary by cooperating in the system-atic use of the following terms. In due course the committee hope to issue a glossary covering the whole range of aeronautical terminology, but the work of selection and definition is necessarily slow when conscientiously undertaken. The committee wish to draw attention to the fact that they have simed at mak-ing their definitions of technical terms as simple and commonplace as possible The definition of ordinary dictionary The definition of ordinary dictionary words that are sometimes used technically has, as far as possible, been avoided, in order to give that latitude of expression so much desired by all writers. In a few cases where certain words ers. In a few cases where certain words are used in contrary senses by different schools of writers—such as "aerodrome" and "airship"—the committee have been forced to take arbitrary setton; it is particularly in respect to the use of such words that the committee dops to meet with the support of the public. GENERAL TERMS.

ARRONAUTES—The entire science of aerial navigation.
Arronautes—The science of busyanoy in air by means of displacement; this is, therefore, the term to be applied to the science of severation.

EBODYNAMICS—The science relating to the effects produced by air in motion; the enects produced by air in motion; this is, therefore, the term to be ap-plied to the science of aviation. EMONTATION—That part of aerial navi-gation dealing with gas-borne or "lighter-than-air" machines.

VIATION-That part of aerial navigation dealing with dynamically-raised "heavier-than-air" machines.

LERONAUT—One who practises any of serial navigation.

Aviatos—One who practises aviation.

Prior—An seronaut qualified in aerial navigation. ENGINEER-In charge of the power-plan

HRIMSMAN—In charge of the steering.
SHED—The use of the term shed is recommended instead of honger.
HARROR—A natural or artificial shelter.

ENOUGH A ground set apart for fiy-ing purposes. The committee do not recommend this term, but, in view of its somewhat general use, suggest that it should be employed only in the above sense. This suggestion is made without prejudice either to its derivation or to its application in another sense by authors such as Langley, Lan chester, and Graham Bell.
Disignate—A power-driven balloon
Amsure—This term having occass

been used to denote aeroplane, the committee recommend its use only in confusion. HELICOPTES A fiving-machine supported

by one or more screw propellers on vertical or approximately vertical shafts.

ORNITHOFTER-A "fiapping-wing"

chine. Lying machine—A general term denoting machines used in aviation as distinct from those employed in aero-

-A flying-machine with fixed planes supported dynamical-ly by its movement through the air. This term should not be used to denote the planes themselves, but should only

apply to the whole machine. motive power.

MILITIPLANE-An aeroniane with two or nore main planes overlapping in plan more form.

BIPLANE—An aeroplane with two superposed main planes overlapping in plan-form.

MONOPLANE.—An aeroplane with a single main supporting plane, which may consist of a pair of wings outstretched on either side of a central body.

on either side of a central body.

'Andrew, Stepper—In some cases aeroplanes have more than one pair of
wings, which may or may not be on
the same level; such planes, if they the same levet; such planes, it tesy do not overlap in plan-form, must nec-essarily be arranged in "tandem"; when not on the same level they are said to be "stepped." For instance, "an aeroplane having three pairs of wings stepped in tandem."

PRINCIPAL DIMENSIONS.

ARRA—This term is not a technical defini-tion unless qualified by an adjective, es, for instance, "supporting" or "effec-tive" area. By area is meant, in the case of planes, the area of the phaq-form, and is therefore measured in units of double surface. That is to say, both sides or surfaces are counted as one unit of area. Thus, by an area of 500 square feet is implied a

area of 500 square feet is implied a surface of twice 500 square feet. Suraxas—Attention is drawn to the distinction that exists between surface and area. See AREA.

WENDET—This being a general term, should only be used when qualified by an adjective, such as "not weight." Not the surface of the surface o plete machine inclusive of all variable quantities, i. e., pflot, fuel, inbricants,

and the second

LOADING-The leading of a machine to

important and Instructive Articles on Aviation

In the Scientific American Supplement we have published in the past few years papeat by some of the more entirent physicists and engineers on thing machines. No book thus for published in excepted and the second particles in which covering as it does attrict in which covering as it does the theoretical side of virsion as well as those more recricial second. the theoretical side of aviation as well as those more practical superts which deal with the construction of machines. The following is a per-tial list of the more important ar-ticles which have appeared in the Scientific American Supplement; see special note below.

see special note below.

2 1616. 1817, 1818, 1819, 1820, 1821

and 1812. The Presention and Theory of Aviations. If Government of Aviations, 1879, 181

¶ 1713. The Wright Asreplane. This is a thorough description of the old type of Weight buyless with the horizon-tal elevation rudder in the front of the machine. Excellent disgrams and photo-graphic views accompany the paper.

graphic vows account by the property of the pr

Illustrates with magninus size precupiration. A complete description of the farmen biplane, with detail drawings of the box tail and vestical reddens, the same of working the four silerons, hand and foot levers which control the machine, plan view and side elevation of the entire machine.

q 1767. The Santos-Dument Mono-plane. An illustrated attcle describing the Denoiselle, the smallest and one of the fastest machines there far made. Sketches accompany the article, showing the details of the construction and control.

Q 1582. How to Make a Gliding Machine. Full details and drawings which will enable anyone to make a glider for \$15.00.

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its gross weight in pounds divided by the supporting area in square feet.

PRINCIPAL PARTS.

LANE—Any element of area used for dynamic support or control. In pure aerodynamics the term should only be used with a qualifying adjective such as "flat," "curved" or "chambered." The prefix "sero" is restricted to the complete machine defined as an "ac

The present use of this term, by ving.—The present use of this term, by analogy with natural flight, denotes each of a pair of planes outstretched on either side of a central body, which wings, if continuous, would form a single

single plane. Sour—In flying-machines, the central longitudinal framework to which the planes and organs of control and pro-pulsion are attached.

CARRIAGE—That past of the machine be-neath the body intended for its support on land or water.

on land or water.

TAIL—In flying-machines, a plane or group of subsidiary planes, which may include both horizontal and vertical planes, behind the main planes.

planes, benind the main planes. Lixvatos—A movable plane or group of planes for directing and controlling the machine vertically.

the machine vertically.

Rudden—A plane or group of planes for guiding a machine to right or left

Balances—in aeroplanes, an organ—
usually a plane—for maintaining latequilibrium

Cigarette Paper

Cigarette Paper

Of the great army of claractic smokone in a hundred who knows that rice
paper, in which the tobacco is wrapped,
has nothing to do with rice, but is made
from the membranes of the breadfruit
tree, or, more commonly, of fine new
trimmings of its and hemp for the common of
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moke. Before being rolled with toof smoke. Before being rolled with tocombustible and give off the minimum of moke. Before being rolled with to-bacco they are analyzed to prove that they are free from all deleterious ingredients and that they contain nothing but the purest paper fiber. Only new material—flax and hemp trimmings—is used, and these are thoroughly purified, Chopped by machinery into minute particles, they are well mixed by a revolving fan, and then reduced to a dust, which is placed in a solution of lime and sods. After remaining in this solution for some time, in order that all for-that all forin the late of the solution of lime and aods After remaining in this solution for some time, in order that all foreign substance may be eliminated, it undergoes a thorough washing process, the water boing the purset kind coming from artesian while sunk especially for the purpose. Then the pulp is rolled out lato paper. At first it is of a grayish product being obtained by an electric process, which in bleaching it also cleans it of whatever impurities might have escaped the bath.

The French manufacturers of eigsrette paper practically supply the entire world, the output of Austria and Italy being insignificant

A Great Atlas of Zoogeography A Great Atlas of Zoogeography

Some twelve years ago there was

Shaunched at Edinburgh, under the
patronage of the Royal Geographic Soclety, one of the most ambitious undertakings in the history of cartography,
viz., Bartholomew's "Physical Atlas". Of
the many volumes projected, only one
the many volumes projected, only one
Total Control of the Control of the Control
Total Control of the Control
Total regar. Now another has appeared, vis., Vol. 5, "Zoogeography." The new vol-ume bears the same relation to the previ-cus literature of zoology as did its pre-decessor to that of meteorology. It decessor to that of meteorology. It takes its place at once as the most com-plete and authoritative cartographical treatment of the subject; and, from the ireatment of the subject; and, from the point of view of acinene in general, it is one of the reference books that hemoerorh no important scientific library can afford to be without. The work contains 85 plates and an extrastive text, the latter including a bibliography of 11 foliopages. The workmanship is on a par with that of the Bartholomew publications graphy; that is to say, it is both appraised to and beautiful.

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15,000	**	••		**	9,000	••	18,000

Larger or smaller sums will start profets in proportion, and the original insertance adequately secured with property constantly becausing its value. "If such inventment start, why are their alternatived? Why does it mostered more after their all their 1." The asserts in the sum of the

How It is Done. The best fruit lands of California, Islaho, Washington, Montana and electrical in the wards face fruits are raised, it leads to the valleys and at the loss of mountain ranger. This later land is the loss of mountain ranger. This later land is the loss of mountain ranger. This called beach had "and the loss of the later land is the later later

The Best Magazines Indorse This Form of Investment

"Collier's Weekly," September 18, 1910

"Morrison's Chicago Weekly," March 9, 1911 "Mecrison's Chicago Weekly," March 9, 1911 It is frequently sked. Will not fruit growing be occasione in the Pacific continent and cease to be profetable? It is asswered by the three three three profetables in the profetable in the three strengths of the profetable in the three strengths of the profetable in the prof

STEPHEN B. L. PENROSE, President of Whitman College, writing on the glories of the Northwest in the "Out-look" of July 24, 1910.

Certainty Is What a Man Soeks in Everything. A Company With \$5,00 Increasingly Valuable Assets in This Valley Absolutely Guarantees All These Land Titles and Perpetual Water Rights. A Company With \$5,000,000 of

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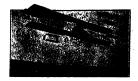
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—Extract from editorial in the first issue of The NATIONAL Post.

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humorous touches.

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days ravely carry loss than 50, and solventures curry as much as 300, yes one bew little curry as much as 300, yes one bew little (12451) C. J. M. asker: De any of your Surpransarrs tell how to make a rhoestatt and if so please give me the numbers, or would be and I will result by return spail. Can they be made to regulate in 50 or 100 degrees. The state of the second them and I will result by preturn spail. Can they be made to regulate in 50 or 100 degrees. The state is a state of the second that the second that is the second to second the second the second to second the second to second the second to second the second the second to second the second the second to second the second

will become study, and a redding may be made in temperature.

(1243) W. M. says: Will you be sufficiently as the common of the wheels in the growerly statube the formation columns, concerning the arrangement such wheels in the growerly asystem used in the Breman monoral installation? All descriptions which I have seen to speak and in the Breman monoral installation? This, as it seems to me, must be an error, because such an arrangement suggest a constrained growers in the secalized directive force of the other. If the secalized directive force of the other, if the secalized directive force of the other. If the secalized directive force of the other, if the secalized directive force of the other. If the secalized directive force of the other, if the secalized directive force of the other. If the secalized directive force of the other, if the secalized directive force of the other in the secalized directive of mass, the use of more than one wheel would are arrises from the section of a studied data for arrises from the section of a studied data for arrises from the section of a studied data for arrises of the second directive force of the second directive for the second dire

full,—hat would refer you to the book ammed and for further information.

(12453) F. D. S. says: In a recent conversation with a gentleman who is agriting in a system of water works here, he make the water through in a system of water works here, he make the water through a scha a pipe under proper conditions of incide without any force but his own band, as but he sated as pipe under proper conditions of incide without any force but his own band, as but he sated as pipe under proper conditions with the proper conditions of incide without any force but his own band, as the water of the proper conditions of the conditions with a second through so great a length of so small a pipe under pay conditions. Will not licidity from the facts in the matter? A. The serticular man must have been sufficied of pipe under a given band, it will sow through another foot is under the rame had additional, and so conditionally. A School clean, less pipe, by JOCcys to recent, world carry God soll, not consider the same spentify, but this words (28,200 Prov) insides a head of 256 feet would designed in a band of 256 feet would





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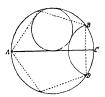


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the day of the control of the contro

some said water, they will give some more exercise, het will not be a strong as at first.

(1948) W. D. writes: A claims that the strong water in the strong water in



circle. Draw a diameter of the given circle taggent to the smaller circle, as AC. From one end of this diameter as a center atrike an arc tangent to the inner circle, and cutting the larger circle at B and D. The are BOD is one-sixth of the circle. Both of these methods can be easily proved by trigomentry. Can anyone give a simple geometrical proof for

Electricity

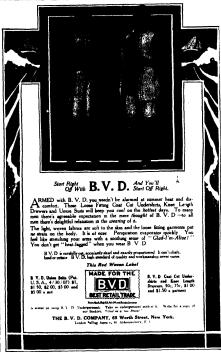
9. 400

Kamehaika Wireless Service.—The Russian Government recently creeted wireless pots so as to make connection between Nikolaiwak on the Amur River and the Kamchaika region. The distance between the two stations is about 800 miles, one being placed at the former lo-cality and the second at Petropaviovak. cality and the second at Petropaviovale. The metallic masts for the serial are 340 feet high. Gasoline regime of 15 horse-power are used to operate the dynamos which supply the current. Signals are now sunt very well between the two posts, and the public can make use of them. Kamehatka, region during the winter, this will be a good feature.

incometive sip, the pulse siles noder its belt (14569). He R. asket: I was in(14569) H. R. asket: I was inSiles Act.—To facilitate the enforcetreated in the method you sire in Notes and
geries No. 1286s for dividing a circle into fave
qual parts. Here is another even simpler,
which I have devised. I worker if it was
invested also centuries before I was born!
A. M. and G. P. M. (time of shores station)
of the wireless and the view of the size of the siz States will receive during the months of May and June between the hours of \$A\$. M. and \$F\$. M (time of shore station) wireless measures from merchant vessels subject to the act, to show that such vessels are 'equipped with an efficient apparatus for radio-communication in good working order in charge of a person skilled in the use of such apparatus.' The Department of Commerce atoms will then be advised. Such measures must, of course, be sent by a vessel at least 100 miles distant from the naval shore station, and preferably from a point 100 miles distant from the naval abore station, and preferably from a point which will show the average maximum radius of the ship'a apparatus. The message should be prefaced by the words, "For Commerce Labor, Washington," and should give the name and the nationality of the vessel; the lattice and longit the ship of full name of operator sending message; and the master's signature full

Dispatcher's Control for Electric Lines.

—A novel device was recently installed by the Indianapolis & Louisville Traction Company in its power plant, whereby the train dispatcher is given absolute control company in its power plant, whereby the control of Company in its power plant, whereby the train dispatcher is given absolute control of all cars on the road at all times. The circuit breakens on the road at all times. The circuit breakens of the road at all times. The circuit breakens of the road of the control of the contro







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Willard in Idaho.—Mr. C. F. Willard, in his Gnome engined Curties biplane at Idaho Falis, Idaho, on April 25th, ex-perienced difficulty in flying on account perienced difficulty in flying on account of the very light air that day and the latitude of 4,700 feet. At no time could he get over 100 feet high. The grounds were surrounded by trees, and Willard found he could fly best over the plowed fields outside. The meet was well at-tended, there being over 5,000 people, coming from all towas within a radius of 100 miles. This was the second flight in Idaho, the first having been made at Bolae City the week before.

Two Brethers Killed by a Fall in Russia,—Within the past month no less than four men have fallen to their death when figure in aereplanea. On May let, while figure together in a biplane at Se-haertonol, two Russian officers, named Mattievich, were dashed to the ground and killed. The same day, Wynnaien experienced a bad fail at Paris. He dropped 300 feet, but happened to strike in a pool of water that was sufficiently deep to save him from serious tajury. The following day Lieut, Roser, of the German army, while flying above the station at Hawsheim (near Mulhausen) had a bad fail of between 100 to 200 feet. He is reported to have been fatally the is reported to have been fatally the is reported to have been fatally the. when flying in aeroplanes. On May 1st jured.

The New Krupp Aerial Terpede.—The Krupp firm in Germany has just brought out a new aerial torpedo, which is said to be far in advance of anything in this line heretofore produced. This torpedo, which has been developed from a Swed-ish invention, is self-propelling and without reaction upon the airship or aero-plane from which it is discharged. It operates somewhat on the principle of operates somewhat on the principle or a sky-rocket, being composed of two parts, viz., an explosive head and a tall chamber containing a slow-burning pow-der charge, the gases from which are discharged through tubes at the rear and drive the torpedo forward. The initial start is given the projectile by means of a start is given the projectile by means of a launching device operated by a light pow-der or by electricity. The gas discharge tubes are set at an angie, so that the projectile rotates on its axis as it moves forward. A very sensitive percussion device is used, and is provided with a same and the projectile has attained a certain speed the projectile has attained a certain speed of rotation. This percussion device is so sensitive that it will explode the torpedo the instant it strikes an inflated gas bag. Patents for the torpedo have been taken out recently in America.

Number of Certified Pilots.-According to official figures obtained by The Aero from affiliated clubs of the International Aeronautical Federation there were at the end of the year 1910 no less than 516 certified pilots. The actual number of licenses issued by all the clubs amount to 578, but this is subject to a deduction of 26 names of aviators now dead and of to 578, but this is subject to a deduction of 28 names of pilots who have taken out licenses in more than one country. When the figures have been corrected in this way, the number of aviators credited to each country is as follows: France, SSS; Germany, G. Engiand SS; Intly, 37; Bellows: Day by day the Engish list is growing, and aviation is being so seriously studied in the United Kingdom now that of a certainty the above figures will be strikingly more to the credit of that country by the month of June even. At the Hrookinads flying ground there are now days when a gale is blowing are no fights made there. On most flays the country has the control of the credit of the country has a subject to the credit of the country has the control of the country by the month of June even. At the Hrookinads flying ground there are now days when a gale is blowing are no fights made there. On most flays three, four, and five machines may be seen aloft at one time At Hendon there are two schools where pupils are trained daily, and the sight is as interesting as at Brooklands. On Salisbury Plain and at Beatchurch and in the New Forest numerous shedg are occupied, while in many law found. The wempenca are of the and the sight is as interesting as at Fronkinds. On Salisbury Plain and at 187 porting chains consist of four fast bands, such made up of 13 thicknesses of plates of the consistency plain and at 187 postenders, is discovered by the plant of the country individual aviators may be a consistency in the country individual aviators are consistent of the country individual aviators are consistent of the country individual aviators and the country individual aviato

Pennya Namia Fire Thoma Thousand Tens of Panama Needs Fire Thousand are see Dynamica—It is estimated that 5,000 tons of dynamics will be required to carry on the work of construction on the canal and the Panama railroad during the facil year ending June 30th, 1913. Of this amount, 3,200 tons must be 65 per cent intro-giverine, and 1,756 tons must be 65 per cent. 60 per cent nitro-glycerine. For the pent year, the estimate was 6,864 tons.

London Passenger Traffic Grows Apace.

The estimated population of Greater London in 1903 was 6,896,090, and in 1909 7,480,000. In the interim, the traffic 1909 7.480,000. In the interies, the traffic had grown as follows: Local railway companies from 291 millions to 441 millions; street cars from 394 millions; for millions; omnatuses, from 397 millions to 311 millions, the total traffic per year having thus increased from a total of 978 millions in 1903 to 1408 millions in 1909.

Damwing the Mississippi.—Work is being prosecuted on the great dam, seven-eighths of a mile long, across the Mississippi at Keokuk, Iowa. The struc-Mississippi at Keokuk, Iowa. The struc-ture will rise 25 feet above the river bed, and along its length will be 119 flood gates 30 feet wide and 11 feet high. At the end of the dam will be the lock gates and a large power house 1,400 feet long and 123 feet wide, in which will be seen that the lock gates and the lock gates and a large will be describe power gen-ratings units. The large power is to be completed July 1st. 1912. July 1st. 1913.

Cofferdam Around "Maine" Completed.

—Now that the cofferdam around the wreck of the "Maine" is about completed. wreck of the "Maine" is about completed, it should not take long to pump out the elliptical basin which has been formed, and expose the wreck of the ship. The first care will be to make a thorough search for boldes. After that will come the investigation of the hull to determine the real character of the supplication which he was the supplication of the supplied to the supplied t calssons, but there is no doubt that army engineers have given this matter most careful consideration.

Oregon Agricultural College.—An engineering show, patterned after the electrical shows which have been given in trical shows which have been given in the large cities of the country, was recently opened by the faculty and students at the State Agricultural College at Corvallis, Oregon. The apparatus and work of civil, mechanical and mining eugineers, and that relating to forestry, was exhibited, the civil engineering section being devoted to good roads, the mining to ores and processes, the mechanical engineering to shop work products and machine oneration and the electrical to engineering to snop work products and machine operation, and the electrical to exhibitions of high tension current, weld-ing processes, wireless telegraphy, etc.

ing processes, wireless telegraphy, etc.

First Auxiliary Sailing Ship.—It is
not true that the auxiliary bark "Quevelly" was the first auxiliary sailing wassel to leave the port of New York under
her own steam; for several years ago
the big five-meated German auxiliary
ship "Rickmers" sailed from New York
under her auxiliary power. Over haif a
century ago, moreover, two American
auxiliary sailing ship of the control of the
this counter, each being southmed with the "Massachusetts," 1846, were built in this country, each being equipped with both sail and steam power. They were full rigged, and their propellers were so adjusted that they could be turned up out of the water. Ner should we forget the old "Savannah," 1819, which was, strictly speaking, a steam auxiliary,

Riveded-piete Cable Suspension Bridge.

—A suspension bridge of curious novelty has lately been built over the Oder River, Breslau, Germany. It is a highway suspension bridge of 415 feet span. The supporting chains consist of four flat bands, each made up of 12 thicknesses of plate interest terrets.

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There is, consequently, a wide and completely setting forth and discu-the prevailing practices in the constru-and operation of these machines. " noplanes and Biplanes" is a new authoritative work that deals with subject in precisely this manner, an invaluable to anyone interested in a

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Mr. Loening, who has come in intimate contact with many of the most noted arisers and constructors and who has made a profound study of the subject for years, a unusually well informed, and it widely recognized as an expert in this inte. In clear and definition with, and an a venant-lead of the subject of a visition. The scientific exactness of the valuable data and references, as well as the high character of the innumerable illustrations and diagrams, readen this work snally the complete that has seen bone contribute to the literature or a surplant of the surplant of the literature or a surplant or a suble of the constraints.



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Mid of time to Consistent De-centile, Scientific American, 361 Middley, New York City.

The Temperature of Haly,—Dr. Flippo Fredia has just published an exhaustive work on this subject, comprising tabu-lated records of the temperature, by tenday periods, from 1886 to 1996, for the meteorological stations of Italy; also statistics of the variability and the range statistics of the variability and the range of temperature, and a large number of charts. This bulky folio volume, which is issued by the Ufficio Centrale di Me-teorologia at Rome, forms a fitting com-panion piece to the same writer's work on the raintail of Italy, published in 1998

1908.
Reflection of Ultra-riolet Light by
Sawn.—Prof. I von Kownald, in a letter
to Neture (London) descending in a letter
vations of the spectra of sunlight serfected by snowfields in Switzerland. He
finds that the ultra-riolet rays are refected by snowfields in Switzerland. He
finds that the ultra-riolet rays are refected by snow almost in their entirety.
This fact helps to explain the trying
effected of such light upon the eyes, and
suggests the advisability of wearing, durling a period of snow and sunshine,
glasses that are opaque to the ultra-violet
rays.

New Physical and Chemical Tables.-The preparation of a new edition of the standard work now known as Landolt & Bornstein's "Physikalisch-chemische Tabelle", hes & Bornatein's "Physikalisch-chemische Tabellen" has been undertaken by Dr. Börnstein, of Berlin, and Dr. Roth, of Greifswald. Those two writers have set an admirable example in addressing a circular to men of science and scientific institutions throughout the world inviting suggestions as to additions, omissions or other chances likely to increase. sions or other changes likely to increase should be sent either to Geh. Reg.Rat Prof. Dr R. Börnstein, Landhausstrasse 10, Wilmersdorf bei Berlin, or to Prof. Dr. W. A. Roth, Karlstrasse S. Greifs

An Arctic Coal Mine.-According to La Nature, the most northerly coal mine in the world is that of the Arctic Coal in the world is that of the Arctic Coal Company (an American concern) at Advent Bay, on the east coast of Spitzbergen. The coal crops out at the surface of the ground several hundred feet above sea level, and is brought down to the harbor by a funicular railway. The company has about 150 men at work, chiefly Norwegtans, who remain on the spot all the year, although Advent Bay is blocked by ice and inaccessible to vessels for olght months: vis, from Novembor to June. About 6,000 tons were taken out least year, but the maximum output has not yet been reached. The chief market for this coal is Norway, which has no coal mines of its own

which has no coal mines of its own which has no coal mines of its own.

The Antarctic Expeditions.—The whole scientific word is watching with intersection of the control o

on the return voxes of the latter after disembarking Scote at McMardo Bound Halley's Comet.—Prof. E. E. Barnard informs us that he is still observing Halley's comet with the 40-inch Yerkes telescope. It is now growing rapidly fainter. His last observation was made on April 25th, when the comet was estimated to be of the sixteenth magnitude in the power of the lengthening sixte because of the lengthening of twilight. Sixten of the lengthening of the power of the lengthening of the power of the lengthening of the power of the still princip of the lengthening of the power of the lengthening of the power of the still princip of the lengthening of the power of the lengthening of the power of the still princip of the lengthening of the power of the still princip of the lengthening of the power of the lengthe





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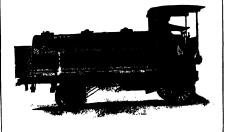
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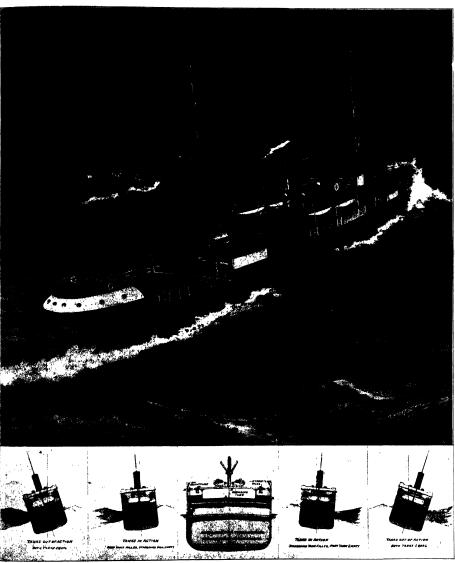


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The device shown above embodies two water-filled tanks, one at each mast, consisting of large side chambers connected at the bottom by a shallow transverse passageway. The flow of water from side to side of the tanks is so far delayed that there is always a large excess of water on that side of the vessel upon which the sea wave is exerting its heeling effect.

SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, MAY 20, 1911

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et combined subscription ratios and rates to foreign community dustribution ratios and rates to foreign community Camada, will be furnished upon application. Results by poolid as sypress money order, limit durft or che

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are short, the articles short, and the rate and more, the contributions will receive special attention. Accepted attacks will be paid for at regular space rates

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Flying in a Wind

CIPPLEMENTING our recent discussion of the conditions of flight in a wind, we wish to make it clear that the article was intended as a word of warning to the novice, and not to the experienced airman. Furthermore, lest the article should lead to confusion regarding the elementary that the control of the confusion regarding the elementary that the control of the confusion regarding the elementary that the confusion is the confusion to the confusion of the confus UPPLEMENTING our recent discussion of laws of motion, we wish to emphasize the fact that once the aviator is clear of the ground, his maneuonce the aviator is clear of the ground, his maneu-vers and all questions of momentum, speed, etc., are referred solely to the new medium, the air. Whether the ari be in movement or not, need give him no concern whatever, except so far as regards those local disturbances, known as "pockets," "air holes," "boulders," etc. The risk in turning when flying against the wind inglit occur only when an axiator failed to distinguish between his velocit," with which was the based of the velocity with second award name to intringuish never in a vince with regard to the earth, and if, because he was moving slowly or not at all over the earth, he omitted, when naking the turn, to bank his machine to the proper degree corresponding to his velocity through the air and the sharpness of the curve described by his acroplane.

So far as the equilibrium of the machine is concerned, it makes no difference whatever (except for
the local disturbances above mentioned) whether
the atmosphere hes absolutely still above the earth
or is moving over its surface at 100 miles per hour.
If it were possible to build an automatic, unpiloted
arceplane, with controls that functioned perfectly
in all the various evolutions, and it were started
in flight over a rectangular or oval course, it would
perform the various maneuvers with just as much
certainty in a wind as it would in still air.

The danger to which we referred would be
entirely to the human clement in the problem—to
the fact that the aviator, particularly if he were
anvice and making his first flight in a wind of
strength, would be liable to refer his speed to the
earth, and not, as he should, to the medium in which So far as the equilibrium of the machine is con-

strength, would be liable to refer his speed to the earth, and not, as he should, to the medium in which he was traveling: the air. It is quite possible that the well-known liability of the beginner to fall when making a turn out of the wind, is largely traceable to this error. As a matter of fact, in a machine flying at 10 miles per hour through the air against a 10-mle wind, and therefore having no speed with regard to the carth, conditions of equilibrium in turning will be exactly the same as if the same ma-chine were flying at the same speed through still air. In each case, were it howsible addenity to reverse

chine were flying at the same speed through still air. In each case, were it possible suddenly to reverse the aeroplane instead of turning it gradually in a circular path, its inertia would tend to carry it onward against the air in its first line of motion, according to the well-known law.

It was the Wright brothers who first olerally demonstrated the proper method of control in turning, namely, by adjusting the tilt of the machine so that its vertical projected area would cause the atmosphere to office the horizontal resistance necessary to combinate the certifular of the resistance necessary to combinate the certifular force, and enables sary to equilibrate the centrifugal force, and enable the machine to make the turn.

The qualified aviator knows that the proper de-gree of banking is determined by two factors, the speed and the sharpness of the curve. Experience has taught him just how far the increased air reachas taught him just how far the increased air reac-tion on his outer wing unfree should be permitted, under the centrol of his own warping devices, to bank his machine to suit the speed and the curre. Furthermore, he judges his speed strictly with re-gard to the air, and not with regard to the ground. Consequently, if he were creeping slowly up to a pylon, against a wind of nearly his own velocity, so that at the instant of turning, he was practically stationary, in putting his rudder over for a sharp turn, he would know enough to bank his aeroplane to the same degree as if he had rushed up to the pylon at 40 miles per hour in still air.

pylon at 40 miles per hour in still air.

But how many of the newcomers, if we except those who have had instruction in a good aviation school, in making their first flight in a wind of strength, and approaching a turning mark at a speed over the earth of a few miles an bonr, would know enought to bank their machines to the full extent required? If the pilot chanced to be a chanfour who had recently turned aviator, by the very instincts of his forner training, he would be liable to manipulate his acroplane for slow speed conditions, and not for the full 40 or 50 miles per hour at which he was traveling through the air. at which he was traveling through the air.

The homeliest illustrations are sometimes the

The homeliest illustrations are sometimes the best. That fight is concerned solely with the medium in which it takes place is proved in the case of a common house fiv when it is flying, say, in a Pullman dining-car. Although the body of air within the car may be traveling at 70 miles an hour over the carth, the motions of the fiv will be made with the same freedom as they would were it flying in the stationary air within the café of a city hotel.

The aviator, then, is concerned solely with his

The aviator, then, is concerned solely with his movement through the air; he has no concern what-ever with the motion of the whole body of air itself, whether that motion be over the face of the earth as a 40-mile wind, or around the earth's center at 1,000 miles an hour as part of the atmospheric belt, or around the sun at 66,000 miles per hour: in the path of the earth's orbital movement.

path of the earth's orbital movement.

We spoke above of a sudden reversal of the machine in a wind. As a matter of fact, this would be impossible. But if it could be done without the interposition of a properly banked turn, the machine, for the few moments before it fell, would be moving tail first against the wind. The same result would follow if a sudden reversal, without the usual turn, could be made when flying in still air—the machine would tend to move onward in the line of its original flight. Both in a wind and in still air, the conditions would be identical. The change in velocity would in the first case be found roro biniums 80 miles per hour, and in the second from plus 40 to minus 40, again a total change of velocity of 80 miles per hour, and in the account

from plus 40 to minus 40, again a total canage or velocity of 80 miles per hour. In conclusion, we would point that the sup-posed difference between the dynamics of flight in a wind and in still air will vanish if we bear in mind that while the gravity of an acroplane in flight is referable to the earth, its inertia, as affecting changes of motion, is not in any sense getrable to changes of motion, is not in any sense referable to the earth, being, in fact, an inherent property of the machine itself. An engineer who has been accustomed, in calculating problems of train accelera-tion and retardation, to refer velocities to the earth, is apt, at first thought and through sheer force of is apt, at next thought and through sheet force of habit, to retain the same reference point in con-sidering, for the first time, the velocities of an aero-plane in the air. The reference point, we repeat, is no longer the earth, but the air itself.

Chutes as Fire Escapes

CORRESPONDENT in New Jersey writes CORRESPONDENT in New Jersey writes to task if we will not give our opinion as to stalled in factories, department stores or other buildings that are crowded with occupants. We gladly so; for we believe that in simplicity, safety and capacity to, handle large numbers of people, the

capacity to handle large numbers of people, the clute offers the very best means of escape for a panie stricken crowd.

The cutte form of fire escape consists of a smooth, metal-lined, inclined plane, of sufficient width to permit the passage of several persons, and whose inclination is such as to insure this gravity, will carry the body safely and surely to the upcured landing at the bottom. For factory buildings it has the advantage that the occupants are perfectly familiar with its operation, and will not hesitate to trust themselves to the descent; for the clute is one of the most popular forms of expter-chute is one of the most popular forms of expterchute is one of the most popular forms of enter-tainment among those factory operatives who prob-

\$150 mm (1/4 m) \$1 可以的现在分词 (1/2 m) (1

ably constitute the majority of the holiday crowds at such places as Coney Island.

The question of finding the necessary space for a sufficient number of chutes to handle the populaa sufficient number of chutes to handle the popula-tion of a crowded building is not so difficult an might at first thought appear. The most practicable chute would be that which consists of a spiral slide inclosed within a tube. The tube need be only a few feet in diameter; and it would be possible to exect several of these against the inner walls that front upon the central court or well. In cases where this was not practical, a separate fire tower, occupying the space now given over to the treach-erous stairways, and shut off from the main building by iron doors, could be utilised for the erection of

The speculative builder, it is true, might raise The speculative builder, it is true, might raise objections on the score that too much valuable space would be required for such devices; but we dare to believe that the growth of humanitarian considerations has reached such a point that, if the building departments of our cities were to make the prevision of commodious fire towers an indispensable requirement of the building laws, they would be exthusiastically backed up by public would be athusiastically backed up by public opinion.

opmion.

The chute is the ideal fire escape. The present exterior fire escapes are liable to be cut off by flame, smoke or asphyxiating gases; the same causes may shut off the elevators; interior stairways may be blocked; but the chute inclosed in its metal tube and built within the chute inclosed in its metal tube and built within a fire-protected tower, offers a certain escape to the ground of every occupant that may reach its upper entrance.

Of Nation-wide Importance

THE passage by the New York Legislature of the bill commanding the Board of Estimate of New York City, at the beheat of the Supreme Court justices, to provide funds for a County Court House in City Hall Park, is a blow against the principle of city home rule, which has a significance that should commend it to the careful attention for the country of has a significance that should commend it to the careful attention of every municipality within the United States. The city authorities are the proper officials to determine what buildings shall be creeted, and where, and how their cost shall be met. Fun-thermore, this bill Is highly pernicious in its effect upon that long-delayed but greatly-needed awak-euing to the importance of the question of the archi-tectural and general aesthetic appearance of Amer-ican cities. The "city beautiful" is no mere dream of the enthusiast, and the recent awakening of the buildie to the necessity for preserving auch parks public to the necessity for preserving such parks and open plasas as we have, and of erecting future public buildings upon some carefully co-ordinated plan, is one of the most encouraging signs of the

Not many months ago, the Supreme Court justices who compose the Court House Board, selected City Hall Park for the erection of a huge court house, whose towering mass would have encoached sadd upon the all-too-limited area of the park, and would have reduced to insignificance the classic and beautiful City Hall—the one perfect architectural gem among the public buildings of this city.

classic and beautiful City Hall—the one perfect architectural gem among the public buildings of this city.

There is no mistaking the genuine character of the outburst of public disapproval of the proposed plan, and the popular indorsement of the substitute scheme for the development of a noble civic genter by the purchase of the blocks immediately north of the City Hall and the erection thereon of the proposed Court House and such other municipal buildings as might from time to time be approved. The present bill is deplorable, look at it from whatever standpoint we will. Not alone does it fly in the very teeth of precedent and the public will; not alone does it exhibit a contemptuous disregard for the professional knowledge and public-spirited efforts of the leading architects of the cenntry, but it establishes a subversive principle by charging our judges, "whose business it is to judge and not to execute," as the New Yerk Times very apily remarks, with the execution of public works. Moreover, it is safe to say that if the Supreme Court justices, who compose the Court House Board, should take any executive action undeasthey pivoly slows of this measure, they will do so reluctantly, knowing full well that their action is liable to ultimate reversal in the Court of Appeals. Never severe the wishes of the citizens of New York made some so that their action is liable to unimate reversal in the Court of Appeals. Never serve the wholes of the citizens of New York made known with clearer emphasis than upon this question of the preservation of City Hall Park. We can conceive of no legislative matter upon which the Governor of the State could more safely exercise his newer of veto.

The state of the s

Vacant Regions in the Milky Way

Herschel's "Windows of Heaven"

By Mary Proctor

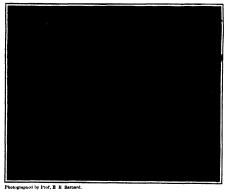
THAT vacent regions of apparently absolute dark-In sees preventi amid the luminous clouds of stars in the Milky Way has been shown by the photographs taken by Prof. E. E. Barnard of the Yerkes Observatory. In these mavelous galactic landscapes, bright, cloud-like masses turrowed by dark rifts and dusky lanes are revealed, indicating seemingly the eventual

MASSES SEASON

the mystery of its origin.
Since the days of Herschel, we have become more familiar with the peculiarities of these vacant regions in the star depths, by means of the photographs obtained by Prof. Barnard. Yet we are not much nearer the solution of the problem concerning these gloomy

deserts of the sky. Are they actual rifts amid dense layers of stars, the "Windows of Heaven," as Heaven, as cheek layers of stars, the "Windows of Heaven," as the sched termed them, giving us a glimpse of Hermensity of space beyond; or are these dark spaces in the sky due to absorbing matter between us and the stars? According to the theory advanced by Prof. Barrard, such matter must, in many cases, be perfectly opaque, for in certain parts of the sky the stars are apparently blotted out. Elsewhere we see them dimly as through a vell, as though a vast nebulous mass drifted between us and the stars. "It is hard to believe in the existence of such matter on such a tremendous scale as is implied by the photographs. As to its nature, if it does extait, accepting to Prof. Barrard, "it must be in some way related to the nebulis, for we find them in most cases to be intimately

connected. Is it an ultimate condition of nebulous matter, or is it something wholly different from the ordinary nebulosity of the sky?" It is believed stars run through their various stages of brightness, until in the course of their career they fade from twe, drifting like black cinders through space, undetected asve where the spectroscope betrays their influence on glow-



The remarkable dark vacancies north of the star Theta Ophiuchi.

The photograph was made with the 10-inch Bruce telescope of Yerkes Observatory on May 8th, 1905 The photograph was made with the short and thirty minutes.

ing suns In like manner the nebulæ may run their course during vast sons of time, drifting like derelicts along the Sliver River of Heaven, as the Milky Way has been fancifully termed by the Japanese "The dying out of nebulæ," says Prof. Barcard, "is a probability fully as warranted as the belief and certainty

that the stars must die."

The frequency of the black openings in the Milky Way, dimly seen with the naked eye in some cases, constitutes one of the most important facts, confirming their appearance as tested by the camera. An admirable delineation of a doubly perforated star-found, which forms part of the vivid scenery of the Milky Way in Bagittarius, was completed at Parsonstown in 1889, by Dr. Otto Booddicker, after five years of labor.

The result was a drawing showing a curloos blending

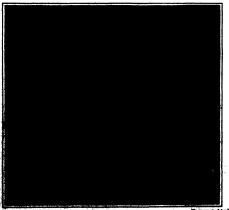
of clouds of stars interspersed with dark rifts, separated by luminous wises and tendrils, as though a celestial bresse had warted them apart Pointed arches, intricate passages, and key-hole aportures onianced the general effect, which was all the more remarkable, as feelers were observed which reached outward toward nebula and clusters and intertwined themselves

around outlying stars like tendrils clinking around a vine Nevertheless, these visual records of barrely perceptible dotalis, in the Milky Way, cannot begin to compare in value with the elaborate wealth of detail shown in the photographs of this region obtained by Prof Barnari.

In a paper road before the Astronomical and Physical Society, December, 1905, entitled "Yacant Hegions of the Sky," he gave the following account of a small star cloud in Sagittarius which can be readily seen with the naked eye: "The photographs show this cloud to be aspecially remarkable for two black holes in its upper part. The east side of the larger hole is very sharrly defined, the cutting off of the stars and the apparently feeble nebulous light is remarkably abrupt, as if someone had drawn its outline with a brush and black paint. The west side of the hole shoals slowly and is not abrupt. So definite is this spot that several astronomers have thought that it may not really be a hole, and that it is perhaps an opaque mass of some sort that cuts off the light from this part of the Milky Way, against which it is seen in black relief My own opinion is that it is a true hole through which we look out into space beyond

where there are no more stars. In the hole is a conspicuous star which has a small attendant preceding. There are one or two other minute stars in the hole."

Another photograph taken of a "long, dull varancy" visible to the naked eye, in a region near Thea Ophischi, resolves itself by means of the camera, into an irregular rift almost encircling the bright means within which the star is placed. Furrowing lanes for itself through the nebulous star mist north of Theta, and straggling westward to the edge of the photographic plate, it finally connects with vacant regions of the sky in the neighborhood of Rob Ophischi. This is a fine but wide double star, and in speaking of it. Sir John Herschied describes it as being on "an intensely black background in a great blank space." The latter (Continued on page 417)



The vacuus lones between Eleo and Theta Ophiuchi.
This photograph was coule on June 2nd, 1900, and plate was exposed exceedy four hour lated was the labeling the best property of the Turkes Observatory.



The great nebula of Rho Ophiuchi and the vacant lanes.

This picture was made on April thi, 1905, with the foliach Bruce tolocope of Yerken Observatory, The reporters was forn bours and thirty missistes.

Measuring the Deviation of Bore Holes By J. F. Springer

THE newer systems of drilling holes into the earth, while wonderfully effective as to the boring operation proper, have manifested a rather peculiar kind of errancy in that they deviate from the vertical. Under the older system, when a heavy chisel-like tool

is alternately lifted and dropped, the bole could, it would seem, scarcely be anything but vertical In such methods as the chilled shot and diamond systems of drilling, where a metal rod is the instrument of boring, it would seem unlikely that anything more than a very minute deviation could occur. Let it be remembered that in these systems the drilling is effected by rotating the drill rod It seems almost incredible to suppose it possible to rotate such a rod in a bent hole. But whether we understand it or not, the fact itself is well ascertained. One cannot, perhaps, give assent to any such story as that of the man who drilled and drilled in from a point in his own mining claim until the bit came up on that of his neighbor. Regarding this as apocryphal, we still have reliable accounts such as follows

Twenty-three holes were sunk by drilling the northern part of France in a circle of small radius. Four of these deviated nearly one foot for every fifty feet of depth until a level of 280 feet below the surface was reached. In another case, it was desired to sink a drill hole along the axis of a shaft four feet in radius. When a depth of 72 feet had been reached the deviation had carried the hole out at the side so that it was no longer serviceable for the purpose of drainage, which was the object sought.

This amounts to a deviation of 1 foot in

18. A hole 750 feet deep was put down in Germany and developed a deviation amount-

Germany and developed a deviation amounting to 47 degrees. This hole was bored by means of a turning bore and iron rods. A hole put down in South Africa to a depth of 4.802 feet deviated the enormous amount of 2,185 feet. This is not as great an angular deviation as in the last case, but the depth here was great. All this may seem merely interesting and curious to those of us who are not engaged in sinking exploratory bore holes parties most concerned, however, it is a matter of trial and difficulty. Thus, in the case where the devia tion of 47 degrees developed, it seemed useless to attempt to proceed after the facts became known. The horemaster had claimed the hole to be perfectly

ln fact, however, It was 2 degrees out at a depth of 200 feet, 3% degrees at 300 feet, 814 degrees at 430 feet, and degrees 750 feet It will be seen from this that the deviawithout warning In this case a deviation of 38% degrees occured in the final 320

It will be intereating to know just how these deviations were ascertained The instrument employed was of the following charactor A glass tube having a bottom perpendic-ular to its sides is filled half full of an aqueous solution of hydrofluoric acid, 20 per cent strong. This chemical of etching or eating away the glass, while at the same time leaving it trans-parent. If the tube containing

the acid be now lowered into the bore hole, a mere or less regular etching will take place due to es-ciliation. It will be easy to disregard this and when quent upon raising the tube, because of the that cons absence of any deep marginal ridge in any direction The instrument containing the tube is, however, allowed to remain a considerable time at the depth at which the inclination is desired. There will re-



THE MACGEORGE CLINOMETER

An instrument for determining the deviation of here holes from the vertical

sult a deep ridge, which may be sufficient to be feit by the fingers. When the tube has been recovered, it may quickly be placed upon a level surface after having poured out a little of the liquid, and allowed stand. A second ridge will now be formed. angle between the planes of these ridges will be the angle of deviation from the perpendicular at the point when the pause of half an hour occurred. To calculate this angle the distance spart of the two ridges at maximum and minimum approach are de-termined. The difference is the one side of a right

(Continued on page 512)



By Lander West.

THE great obeliek that stands on the pit
I front of St. Peter's in Rome has a lateo
involves in its record more of the circumstan ory that war and pemp, traditions of remance, and melodramatic glamor than anything that has been handed

down concerning any one of the other forty-

eight Egyptian obelisks still in existence. These mighty shafts, quarried from red granite, or syenite, and a few of hard sand-stone, were erected by the sun-worshiping Egyptians as a figure representing a ray, or a pencil of light. The sun was the god "Ra." and appeared upon the monuments and on the papyri under various forms. The greatest monuments representing "Ra" were the obelisk and the pyramid; the were the obelisk and the pyramin; the latter symbolical of the setting sun—dark-ness and death. The obelisk as the ray or needle of light seems to be like the uplifted pyramid seeking penetration, for its cap bears the pyramidical shape, and so in melancholy distinction the pyramid ap-pears to be the top of it sunken low in the desert sands.

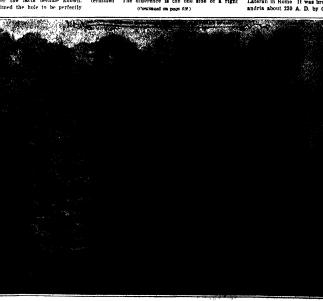
Of the forty-eight remaining out of the hundred that were doubtless placed by Thothmes III. and Rameses II., ten are lying prostrate and thirty-eight are thus distributed—nine in Egypt, two in Con-stantinople, twelve in Rome, six in Naples and other parts of Italy, two in France, four in England, two in Germany, and one in the United States, whose recent history as told in the tremendous task undertaken by Commander Gorringe of the navy to bring it from Egypt and place it in Central Park in New York city, was full of strenu-ous and interesting detail. But the history of all these obelisks can be obtained from a vast array of bibliography, much of

which is still to be translated from the Italian and French records -particularly from Fontana in his "Della trasportatione del Obelischo Vaticano" (1500) and "A History of Obelisks" by L'Hote (Paris, 1836). There was one obelisk erected in Heliopolis by tesen I. between 2758 and 2714 B. C. that still exists. All of these shafts are more or less covered by hiero-glyphics, excepting the one in front of St. Peter's, which is bare.

The largest obelisk is on the plazza of St. John Lateran in Rome It was brought from Thebes to Alex-andria about 230 A. D. by Constantine the Great, and

thence Constantine, by Constantine, who placed it in the Circus Maximus. It ures in height 108 feet and 7 inches and weighs 455 tons. On the fall of Rome it was broken in three pieces and lay neglected on ground until Pope Sixtus had it taken from the ruins ins and re-ored in 1588. The obelisk Central Park is nigh, nearly 8 feet square at the base and weapen 448,000 pounds, or 224 tons. The London obelisk is 68 feet 5 inches high, 7 by 8 feet at the base and weighs 209 tons. The "St. Peter's Obelisk" was

betimated Fontana to weigh 320 tone. It was Heliopolis to Rome by Caliguta and placed in the Vatican (er Nero) Cirous.



SIXTEENTH CENTURY ENGINEERING Eight hundred men and one hundred and fifty horses raising fit. Peter's obelish,

4

The same of the sa

The Competitive Designs for the New Quebec Bridge

A Notable Competition Involving Thirty-eight Separate Plans

FINALLY, after the lapse of nearly three years' time, and the expenditure of several hundred I time, and the expenditure of several hundred thousand dollars in the preparation of plans by the Special Board that has been in charge of the drawing up of designs, the Canadian government has rejected sed on the plans of their Board and has accepted a design based on plans prepared by the St. Lawrence Bridge Company.

e Scientific American has taken great interest in this question of the new Quebec bridge, both because, in respect of the length of its main span, it is destined to be the most notable bridge yet constructed, and bewe consider that it would be deplorable if the Canadian people, when carrying through their greatest engineering work, should fall to make it absolutely first class, both in design and construction.

The plan proposed by the government's Board of

we have never liked. From the over-lightness of the bridge that failed, the Board swung over excessive weight

and an extravagant use the general contour of their design for the bridge was not pleasing. In fact, as will be seen from the ac-companying diagram, it lacked altogether a certain grace and harmony, which is present in the two cantilever signs presented in our drawing, and is conspicuous in the suspen-sion bridge proposed by the only competing

erican firm

The tenders were based on plans and specifications of the Board of Engineers; but contractors were liberty to submit tenders based upon plans prepared by themselves. The bidders were the St. Lawrence Bridge Company, of Montreal, who secured the contract; Maschinenfabrik Augsburg-Nurnberg, A. G., of Gustavaburg, Germany; the British Empire Bridge Com-pany, of Montreal, and one company from the United States, the Pennsylvania Steal

Company, of Steelton, Pa. The plan of the government Board of Engineers called for a cantilever bridge in which the anchor arms and the cantilever arms, respectively on the shore and river sides of the main piers, were to be of the same length, and the middle suspended span, 586 feet in length, was to be ing, or by cantilevering out from the ends of the cantilever arms. The Board also prepared five modifications of this design, and a tender on of the six propositions was considered a tender on the or case six propositions was consistence a renew on the Squard's design. In two of these schemes, the sus-panded span was to be erected by the overhang method, and the other four egatemplated erecting the span upon pontoons and floating it into position. We show a design of their own, submitted by the Ger-man firm, the notable features in which are the unman in the notation entering in which are the distance when the great tength, nearly 800 feet, of the suspended span. It was to be built of chrome-nickel steel, and the tenon elements were to be built-up riveted members reduction. This firm also bid on three of the de-sma of the Board.

gas ut the Fourt.
The British Empire Bridge Company put in six
is, all based on the designs of the Board of Enbears. They proposed to erect the central span by
sating is into place.

The Pennsylvania Steel Company submitted ten

tenders on the designs of the Board, and one tender for an eye-bar suspension span, the plans for which were prepared by Mr. Gustav Lindenthal, and which, from the standpoint of appearance, was unusually attractive. The successful bidders, the St Lawrence Bridge Company, put in a bid on each design of the Board of Engineers, and also seven bids on designs prepared by themselves.

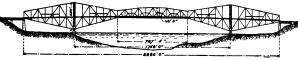
The accepted design received the approval of the majority of the Board, backed up by the experts ap pointed by the Canadian government sidered that there were several particulars in regard to erection which made the plan preferable Board's design. The bridge will have what is known as the "K" web system for the cantilevers, and a modified Pratt system for the suspended span, which 640 feet in length. All the members of the anchor

tonnage of steel required for the former being 148,-000,000 pounds, and for the accepted design only

Although the accepted design is superior to that of the Board of Engineers, we cannot regard it as entirely satisfactory when compared with the largest cantilever bridges already built in the United States. All three of these have been constructed across the Ohio River, and in general, they have an over-all length of 1,500 feet and a main span of 800 feet be-tween towers. The last of these to be erected is that tween towers I rie hast of these to be received is that the aver, Pennsylvania, which was recently described in a paper read before the American Society of Civil Engineers. It is an exceedingly heavy structure, built for E-60 (6.000 pounds per linear foot of traffic as against 5,000 pounds on the accepted designs for the Quebec bridge) The Beaver Creek

bridge is excellent in its details, in its adaptability for economic erection, and in its general appearance; and it is to be hoped that equal merit these respects will be developed by the design which has now been adopted for the Quebec





hinenfabrik Augsburg-Nurnberg A.G.





OUTLINES OF THE COMPETING DESIGNS FOR THE NEW QUEBEC BRIDGE

arm, and those standing immediately over the main pier, together with the floor system, will be built of carbon steel; and nickel steel will be used in the cantilever arms and the suspended span. The top chords will be composed of built-up riveted

It is a noteworthy fact that the successful design is not based upon either the plans or specification the Board of Engineers, but upon entirely independent plans and specifications for a much lighter bridge of smaller capacity than that contemplated. Board's design called for a bridge providing railroad tracks, each capable of carrying an I locomotive followed by a distributed train load of 7,500 gounds to the lineal foot; two 20-foot roadways with 2,000 pounds per linear foot, and t foot paths. The successful bidders put in a tender for a much lighter bridge, from which the two roadways were omitted and the loading for the two tracks was reduced to an E-50 locomotive followed by a load of 5,000 pounds per linear foot. Two foot paths were also provided. This great re-duction in the loading necessarily led to the lightening up of the whole bridge, and a reduction of total cost, as is shown by the fact that the bids varied from \$18,000,000 for the Board of Engineers' design to \$8,650,000 for the design as above given, the total

The Eighth International Congress of Applied Chemistry

A PRELIMINARY announcement has been sent out of the Eighth International Congress of Applied Chemistry, which is to be held in Washington in 1912 The President of the United States has taken a great interest in this important event, has consented to and named as its patron He has further shown his solicitude for its success by inviting all the governments of the world to take part On the council presiding over the affairs of th congress are many prominent members of the American chemical profession, the presi-dent being Dr William H Nichols, and the secretary Dr. Hernhard C Hesse, both of New York city. Among the

other members may be mentioned Dr. E G. Acheson Dr. L H Backeland, Prof W D Bancroft, Prof Charles Baskerville, Prof Bogert, Dr G F. Kunz, Prof Charles F. Munroe, Dr H. Schweitzer, and Dr H. W. Wiley.

Natural Gas

THE natural gas industry of the United States in the year 1909 surpassed that of any previous year in quantity and value of the gas produced mated value of the gas produced from wells and con sumed in 1909 was \$63,206,941, as compared with \$54. 840,374 in 1908, a gain of \$8,566,567. This increase was due to several causes. To the increased demand for gas as a result of greater prosperity in the manu facturing centers of the country, following the de-pression in business and financial circles in 1908, to the completion of pipe-line systems and distribution in districts not heretofore supplied; to the advance in the price in some sections, and to the more complete canvass made of the gas producers

With continued improvements in business, greater activity in drilling operations and the completion of the new pipe-line systems under construction in 1909, the indications are that the output of 1910 should be even greater than that of 1909.

Anti-rolling Tanks for Steadying Ships at Sea

How Artificial Waves Are Made to Counteract the Waves of the Sea

A LTHOUGH the fore and aft motion (pitching) of a ship is more distressing to many passenge than the rolling motion, the latter is the cause of such general discomfort, to say nothing of seasickness, as to render the elimination of rolling a most desirable object. Furthermore, since most of the naval engagements of the future will be fought broadside to broadside, with the guns trained athwart the ship, any device which will eliminate rolling must have a most important effect upon the accuracy of gun fire. For the above reasons, it is not surprising to find that anti-rolling devices have been made the subject of much theoretical investigation and some very costly practical experiments.

The best known of these, blige keels, are to be found on every ocean-going steamship. The blige keel is a fin-like plate-steel structure, which projects at right angles to the ship's plating, and extends at the bilges (the point where the bottom of the ship rounds up to the sides) for about two-thirds of the length of ship. They are arranged parallel to the longitudinal of the ship, so as to present the least possible resistance to progress. Although blige keels reduce reling, they by no means eliminate it, and, of course, their large surface develops a considerable amount of skin friction resistance to the progress of the ship through the water.

Several years ago, that distinguished engineer, Thornycroft, designed and built an anti-rolling de-Thornyroft, designed and built an anti-roining u-vice, consisting of a very heavy weight, plywied on a vertical axis and controlled by hydraulic power, which was moved from side to side in such a way as to counteract the heeling effect of the waves. It was fairly efficient in the ship in which it was installed; but its high cost and the considerable dead weight which had to be carried, prevented its adoption in commercial service.

That wonderful mechanism, the gyroscope, has also been called into service for the steadying of ships at sea. In this case, the resistance of the gyroscope to a change of its plane of motion is utilised to resist the tendency of the ship to heel under the action of the waves. Readers of the Scientific American have been made familiar with this device as worked out by Schlick, whose apparatus has proved very officient in the chine of small size in which it has been A recent improvement in gyroscopic con trol is that of Sperry, whose invention of what he calls the "active" gyroscope promises to provide, for a given weight of gyroscopic apparatus, a vastly greater controlling effect than is possible with the Schlick gear. Tests recently made by Naval Con-structor Taylor, at the naval testing tank, Washington, seem to prove that this device will give a very plete control of rolling.

The earliest anti-rolling devices were of that type which forms the subject of the present article, namely, closed tanks of water built within the hull of the ship. In its simplest and earliest form, the anti-rolling tank consisted of a large, clos tangular chamber, built across the ship, and filled with water. The theory of these tanks was that when the ship, under the action of the waves, rolled, say, to starboard, the water in the tank would rush over to starboard; and that, as the ship, under wave action, rolled back to port, the body of water in the tank would lag to starboard, and tend to damp or check the roll of the ship to port.

Now it can be seen that the action of the water in the tank would be effective only if its rushing from the tank would be effective only it its rusning from side to side took place in a definite relation to the rolling of the ship. In other words, to check the ship's rolling the motion of the tank water must al-ways lag a certain amount behind the rolling of the

Now this was just what failed to occur in the early rolling tanks; and it soon became evident that sor system of control of the tank water was necessar which would insure that there should always be a surplus of water on that side of the ship on which the heeling effect of the wave, at any given time, was being felt.

As far back as 1883-5. Sir Philip Watts read be fore the Institute of Naval Architects, Great Britain, some papers describing experiments with an athwart some papers describing experiments with an ataward-ship, water-filled chamber, which was installed on the old iron-clad "inflexible." The trial of these tanks gave promising results; but it was impossible to control the water, and the size of the tanks was so great that they encrosched upon space greatly needed for

other purposes,
Of late years the investigation has been taken up
by Herr H. Frahm, a German member of the Institution of Naval Architects, who read, at the last me ing, a most valuable paper, in which he gave a luid account of the theory of the rolling tank, and exhibited diagrams of the devices by which he has overcome the difficulties experienced in the early "Infexible" experiments. This he did by reducing the size of the tanks and placing the motion of the contained water under proper control.

Perhaps it will be as well just here to quote from Herr Frahm's paper: "This result has been obtained by the most careful application of the laws of r . . Under the effects of resonance, bodies that can oscillate about a condition of equilibrium are made to swing severely under comparatively small impulses, as soon as the period of oscillation of the impulse is synchronous with the individual periods of the respective bodies. A ship constitutes a body of this kind, as she will oscillate under the impulse of the waves. As is well known, a ship will roll al-most exactly in the periods of her individual oscilla-Large heeling amplitudes can be pro duced on a ship only if she is struck by a series of comparatively regular waves, and struck in the measure of her individual number of oscillations. Under such circumstances the influence of resonance will

be promptly fait, and there will be an increase of the angle of heeling from wave to wave. All large roul ing amplitudes observed in practical seaffiring ar-due merely to the indiscose of resonance between wave and vessel. On this fact the present devise has been based. It utilises a secondary and artificial resonance in order to annihilate the indiscense of the resonance in order to annualists the industries of the primary resonance between waves and ship. This secondary resonance is introduced by means of a U-shaped tank, located athwartship and emtending from side to side, in which a water column can oscillate with the same number of swings per minute that are peculiar to the ship herself. . . . The ship will heel only as far as the water, under the action of secondary resonance, rises or falls in the vertical tanks to such an extent that the heeling moment imtanks to such an extent that the neeling moment imparted to the ship by the waves is balanced by the operate turning moment, produced by the oscillations of the water. The increment of healing, from impulse to impulse, in a free ship, cannot take place now, and the rolling motions will be limited to such as will be sundetest to produce the necessary oscillations of the tank wat

In the earlier tanks a free wave rolled from side to side in an open chamber; whereas in Frahm's tank the water column is inclosed in a carefully-dimensioned chamber, where it parforms uniform move ments, which can be controlled by blocking the connections. The tank consists of two capacious chambers, one on each side of the ship, connected at the pers, one on each surface the many commerce at the bottom by a shallow passage for the transference of the water. Curved disphragms leading from this passage into the side chambers act as hadie plates to control the flow, and the air passage connecting the upper parts of the vertical tanks is provided with a throttling air valve, by which the passage of the air as it is forced from side to side of the ship by the rising and falling of the water can be obstructed rising and raining of the water can be obstracted with a view to adjusting the oscillations of the tank water to the condition of the sea. Also by closing the valve, the movement of the water may be blocked.

The first experiments were made as the pleasenger scenarior "Ypiranga" and "Corcovado." These ves-

sels are 447 feet long, and have a loaded displace ment of 14,100 tons. The tanks are placed above the water line, as shown in our front page engraving, there being one forward and one aft of the amidahip The total quantity of water in each seen nouse. The total quantity of water in each tank is 94 tons. In rough weather during voyages from Germany to Argentina or Mexico, it was found that the rough-weather heeling angles of 11 degrees to either side were reduced, when the rolling tanks were in action, to only 2 degrees to 2½ degrees. On another occasion, when the tanks were out of action. the ship was rolling 18 degrees on each side of the vertical; but when the tanks were liberated the roll-

ing reduced to from 3 to 4 degrees.

When the tanks are in full action, they exert a turning moment of 2.790-foot tons

Correspondence

Why is Saccharin Valueless?

To the Editor of the SCIENTIFIC AMERICAN The recent decision of the United States Department of Agriculture in declaring one of the chemist's greatest discoveries as of no value is far reaching in

The use of saccharin as an economic sweetening agent in thirty or more food products is to be abandoned Saccharin has been used to sweeten canned corn, peas, and tomatoes, sarsaparilla, cream sods, and other soft beverages; champagne and liquors. Its use will be unlawful after July 1st.

Dr Wiley, Chief Chemist of the United States De partment of Agriculture, appears to put little faith in the value of coal tar products, among which may be mentioned acetanelid, benzoic acid, vanillin, and the aniline colors, yet all these substances have been heralded as great economic discoveries While the Remsen Referee Board has heretofore persistently disagreed with Dr. Wiley, it has delightfully agreed with him in the abolishment of saccharin, and has classed it as a worthless coal tar product.

We would not for a moment think that Prof Ira Remsen, who is perhaps the most influential member of the board, could have his decision influenced by an incident which occurred in his laboratory some twenty-seven years ago, yet herein lies the history of

In 1884 a clever student, while working for his doctor's degree at Johns Hopkins University, with the hope of preparing a new, but most likely unimportant, derivative of toluene, happened to taste his product and was surprised at its intense sweetness. come with the visions of a fortune in its tremendous commercial possibilities, he completely forgot the procommercial possibilities, as compared not for the pro-fessor who planned the research work laid out for him, and immediately resigned from the university. The professor was Ira Remsen, and the student a Dr. C. Fahlberg. This incident caused the wrath of Prof. Remsen, and a great outery of indignation was aroused throughout the university world, which accorded all moral right of the discovery to Frof. Romsen. Dr. Fahlberg, however, secured all legal rights to the discovery by the granting of a United States patent to him on June 2nd, 1885, for the "mannof saccharine compounds." The patent was granted for the preparation of sugar compounds, the word "saccharine" being synonymous with sugar. In this process no sugar or sugar derivative is samployed, and this is why Dr. Wiley deems packages marked "saccharin" misbranded. Rights of the manufac-turers may be sustained from the fact that a final "e" this process no sugar or sugar derivative is emp is found dropped from the word "seechasine"

as round cropped trust new word "accumance" maccumance applied to the coal tar product.
Saccharin has a chemical name, bensole smittides,
til se extensively used, in households, to swinders, the
food of diabetic subjects, an extremely small challed
being equal in weetness to a large trusp of smaler,
when used in coiline, tes, po cooca. Pure sandards in

550 times as sweet as sugar. A sweet taste may be

550 times as sweet as sugar. A sweet taste may be imparted to 70,000 parts of water.

But Dr. Wiley says this valuable substance impairs dispection, and should be dispensed only upen a physiolan's prescription. So sacoharin must go, a valuable industry is destined to be roined, and the chemist must search for a sweet coal tar product which will not impair digestion. We may not wholly e with Dr. Wiley and the Referee Board, but I that they have at least weighed the evidence of the that they have at least weighed the evidence of the other side in coming to so far-reaching a decision. But we certainly cannot agree with a New York daily newspaper, which brands the wonderful substances as "No gedt."

Stapleton, N. Y.

Plage for Air Yachts

To the Editor of the BURRETTE AMBRICAN:

Through the columns of your paper I would like to suggest to all interested in aerial navigation that they use their influence to get the Government to adopt a special type of energy for use on all sectal crists, or at least upon that class corresponding to the privately owned marine yacks.

prevancy owned marine years.

As a suitable form of fine for this purpose, permit
me to suggest an conign similar in design to that
known as the U. B. yaidi easign, but with one change,
manuly, that instead of the forste meabor; it its jaidi
there be substituted a two-binded nerial segme in the ensign for serial craft.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Hearing How Hot It Is

CTRO COSTA, an assistant in the polytechnic school of Rio de Janeiro, has invented a pyrometer based on the variation in the pitch of a musical pipe with change of temperatu e. The instru ment (Fig. 1) consists essentially of two closed organ pipes or whistles a, b, attached to the ends of a tube a which serves as a wind chase and is supplied with air by means of the lateral orifice, which communipiece. A second flexible tube connects the ear of the operator with the lateral orifice of the wide tube h, which surrounds the tube c and the mouths of the whistles. The effective length of the whistle a can be varied by moving the piston e, by means of the rack f and pinion g. This length is indicated by a scale attached to the rack. All of these parts are attached to a cylindrical frame which surrounds the whistle a

and terminates in a handle n. Fig. 3 il-lustrates the manner in which the temperature of a furnace is determined with the aid of the acoustic pyrometer. The the aid of the acoustic pyrometer. The end of the instrument to which the whistle b is attached is inserted into the furnace, while the whistle a remains out-side the furnace. The length of the whistle a has been adjusted so that the two whistles shall be in unison when the desired temperature is attained in the interior of the furnace. terior of the furnace. The stoker sounds the two whistles simultaneously by blow-ing into the mouthpiece connected by a flexible tube with the wind chest c the pitch of the hot interior whistle b is lower than that of the cold exterior whis-tie a, the furnace is not hot enough; if bis higher than a, the furnace is too hot. The approximation to unison is announced by beats which can be recognized by any one. If the pyrometer is used by a person endowed with musical sensibility, the whistles can be sounded separately by providing the tube c with a central partition and two orifices communicating by two fiexible tubes with a double mouthpiece, rither side of which can be stopped at will by the tongue, while the operator has both hands free for the manipulation of the instrument.

The portable pyrometer, the description of which is quoted from Le Génie Civil. is inserted into the furnace from time to time, during the firing. In another form e apparatus, shown in the upper part of Fig. 2, the whistles a and h are attached to the outer and inner surfaces of the furnace wall and are blown continuously by compressed air, which enters through the orifices dd, so that any change in the temperature of the furnace is instantly de tected. As in the portable instrument, the lated by means of a rack and pinion and

Either form of the acoustic pyrometer

a furnace or other inclusure as well as to announce ement of the temperature desired. The temperature at any moment is measured by adjusting length of the exterior whistle until the two whistles are in unison. According to the law which governs the velocity of sound in gases, the tempera-tures sutside and inside the furnace are then protures, obtaide and made the furnace are teen pro-portional to the equare of the effective lengths of the exterior and interior whisties. The length of the interior whistie is practically constant and known; the external temperatures is also nearly conand can be determined by a detached ther-tion. From these data and the scale reading of the exterior whistle, the temperature inside the fur-nace is easily computed, and even this simple calcu-lation can be dispensed with if the scale of the exterior whistle is so graduated as to give the in-ternal compensature directly.

The solution prymeter must obviously be made of majorials, smale as platinum, carbornatum and silumination, which are not affected by high temperatures. Silumination is ampedially suitable for the construction of the time.

The immediate precision compares favorably with other approximates in joint of accuracy, supecially at

very high temperatures, and it presents the advantages of remarkable simplicity, almost perfect security against derangement, and the possibility of giving continuous indications at a distance to a large number of workmen. The ear is so quickly educated that a little practice makes it easy to distinguish the sounds of different instruments, so that one person can attend to several pyrometers and

Modern Light-proof Wall Paper

M OST wall papers soon change color under the influence of light, either fading or turning brown. The latter change is due to the presence of wood pulp. and is most conspicuous in wall papers which are not completely covered by the printed design. Fading is due to the employment of colors which are bleached by exposure to light.

THE REPORT OF THE PARTY OF THE A. W. March

HEARING THE HEAT OF A FURNACE

The attempt to produce brilliant effects at small cost has led to the employment of wood pulp and fugitive colors, but it is possible to obtain light-proof wall paper by exercising caution in purchasing and

The question, in so far as it concerns the German wall paper market, was discussed by Dr. Paul Krais at a recent meeting of the Wurtemberg Chemical So-An eletrant of Dr. Krais's address which was published in the Leitschrift fuer angewandte Chemie, is here presented:

Modern wall papers are of several kinds, which differ in the method of production and also in price. German wall papers have a uniform width of about 20 inches, of which about 19 inches are printed, leaving a half-inch blank margin on each side. English wall paper is 22½ inches wide. The paper is made and printed in rolls either 4,000-5,000 feet or 23,000-25,000 feet in length, but is sold in rolls of 26 feet in Germany and 36 feet in England.

he three principal varieties are "natural," and "ingrain" papers. A fourth variety, "velvet" paper, is now little used. In natural wall papers the design is printed on paper which is either white or niformly throughout its mass by distemper

colors mixed with the pulp, while in foundation wall papers a uniform ground color in distemper is applied to the white or tinted paper before the design is printed. Ingrain paper is made on a duplex paper machine by which a layer of ordinary pulp is combined with a layer of pulp covered with fine wool fibers.

The wool side of the paper is colored on the same or a special machine, and the design is printed in rent colors, or glazes

Ordinary wall paper is printed with pastes composed of pigment, water and golatin or caseln. The printing is done with wooden cylinders on which the design is engraved or outlined by brass wire and foil. Large areas of the same color arc fitted in with felt for the purpose of holding the paste. One printing cylinder is required for each color, and the paper is passed several times through the printing machine for the production of special effects.

Satin papers go through a brushing machine before printing Gold and bronze effects are ob-tained by using metallic pastes Damask, moiré and relief effects are produced by passing the paper between a hard metal cylinder, on which the design is engraved, and a soft roller, made of compressed

Salubra, lincrusta and leather papers are printed with oil paints and varnishes. In making salubra paper, a coat of lightproof oil color is applied to a specially prepared parchment paper, and the design is printed on this ground in other light-proof oil colors A pressure of 230 at-mospheres, with which any desired relief effect can be obtained, is employed in printing. Paper made by this method is much more durable than common wall naner and is almost light proof It can be washed more easily and safely than a coat of oil paint, and, unlike the latter does not crack A variety of salubra paper, called tekko, is recommended as a substitute for textile wall hangings. Tekko is printed on parchment paper, with metalpowders, so colored and prepared that they are light-proof and do not tarnish in the air Relief effects are also introduced

In velvet paper, also called velours or beaver paper, either the whole surface or a pattern is covered with an adhesive and sprinkled with fine wool fibers | Intermediate between ordinary wall papers and the heavy water-proof papers described above are the papers printed thinly with oil colors by lithography or otherwise, which are produced by a few firms.

The wall paper industry is less than

100 years old, and the general use of paper began with the invention of the printing machine, in 1852 Early wall paper was printed with hand blocks, and was too costly for common use Some fine wall papers are still printed by hand. The industry is now one of great im-

portance Germany alone possesses 60 wall paper factories 21 of which are asso-

ciated in a trust. The industry gives employment to a great many workers, and it requires much technical and commercial ability. Changes in pub-lic taste cannot be foreseen, and a rash manufacturer is apt to find himself overstocked with unde-sirable patterns, which must be sold at a loss. The lowering of prices by competition is not the only reason why most wall papers are not light-proof general desire for striking and gorgeous effects is only too easily gratified by the employment of cheap, brilliant and fugitive aniline colors

In recent years the efforts of the Duererbund and other associations, and of individual artists and decorators, have begun to effect a reform in public taste and to inculcate a knowledge of the qualities, and cally the fastness of color, which should be demanded in a paper for which a good price is paid. The makers of aniline colors were well aware of the degradation of their industry, and they have expended money, labor and skill in efforts toward improvement. These efforts have so far succeeded that it is now possible to obtain aniline colors sufficiently lightproof to meet all reasonable demands

The production of light-proof wall papers is attended by serious difficulties. Fast colors are much more

costly than fugitive colors, and the manufacturer's loss on unsold stocks is correspondingly increased. Furthermore, not every fast color is suitable for wall paper printing, and colors which are light-proof when muck separately may prove fugitive when mixed. Orest care must be exercised, also, to prevent the accidental introduction of the fugitive colors which are necessarily used for the cheap wall papers made in the same establishment.

A wall paper which is sold as light-proof, at 25 to 50 cents per roll (in Germany) ought to show little change in fave years, which is the limit to the life of a wall paper determined by considerations of cleanless and hygiene, and changes in fashion and occupancy. The paper need not be free from wood pulp, if it is a ground paper, entirely covered with light-proof opaque pigment Washable papers should last much longer than five years, but even this degree of permanence cannot be expected for a 4-cent roll of thin wood pulp paper, printed with the cheapest colors.

The Patent Expert

IN a paper on the patent expert, read before the Boclety of Mechanical Engineers, Mr. E. W. Marshall pointed out that in the present method of patent litigation, an important part is played by professional witnesses, designated more or less im-properly, "patent experts." Many engineers are called upon, from time to time, to give testimony of this kind, and all are directly or indirectly interested in the judicial determination of the question involved. true status of the patent expert," says Mr. Marshall, "is not that of a hireling without conscience, who can frame his opinions according to the wishes of his employer, and who, under oath, can say whatev he likes for or against the cause, according to the side which engages him. In presenting a case to a judge . . the terms of the patent should be de-fined for him, its claims interpreted, and its relation to the art to which it pertains explained by those familiar with the scope and meaning of claims, and acquainted with the art in question For this purpose only are patent experts engaged

Experts are obviously partisans . . in the sense that they exercise their entire ability to set forth every fact which . . may be fairly construed to be of advantage to their side of the case

"An expert is a man instructed by experience Hemust possess such peculiar knowledge and skill attained by previous habit or study as to make himmore capable of forming a correct judgment upon a subject matter than an inexperienced person.

"The method of taking depositions follows federal law and practice. The expert's testimony is taken in any suitable place before a duly appointed examiner, in answer to questions. The examiner usually disappears after he has sworn the witness, leaving him at the mercy of his counsel and that of the opposing counsel, who question him and cross question him to their hear's content. Objections to questions or answers are put upon the record. Sometimes the proceedings are interrupted to argue an objection he of the opposition oppo

"In the first part of his deposition the expert gives his qualifications. He tells what his training and experience have been, any facts which tend to show that he is competent to assist the court, and that his opinions and especially the reasons upon which he founds his opinions on the questions at issue are worthy of consideration.

"If he is retained by the complainant, the expert explains the patent in suit and its claims, and points out wherein the alleged infringement lies, usually coupling the various parts of the infringing device or substance with the olements of the patent claims

The expert for defendant tries to set forth facts which tend to hvalidate the patent or to limit its scope, and also to show non-intringement. It is to be borne in mind that all experts evidence is given for the purpose of enabling the court to determine material experts of the purpose of enabling the court to determine material experts defens terms of the art of law and latting to usury the functions of either court or counsel. Experts define terms of the art or the state of the art at any given time; describe machines, models or drawings exhibited; explain the machines, models or drawings exhibited; explain the which exist in various devices, or which are involved in their construction.

"The expert's deposition lays foundation for the counsel's brief. The judge probably reads but little of it. It is important to get in facts and statements in clear, concise language, as free as possible from technicalities, which can be used by counsel. There

are two aides to every question. The expert who refuses to admit or concede obvious facts cannot hope to have the same influence as the one who shows himself to be broad-minded and fair. But in making such concessions great care should be exercised in selecing the terms of expression used, for lawyers are only too apt to take any of the statements removed from their contexts and to enlarge upon them for the purpose of impressing the court in a way far betuned assumed to the statements of the surpression of the purpose of the pression of the purpose of the statements who without the purpose of the purpose of

yond anything intended by the witness. "The witness will be interrupted by objections both to the questions saked him and to his regiles. The class he is familiar with the rules of avidence has should pay no attention to them. They relate only to legal schnicalities. Ho should not regard them as personal, but should only follow the direction of his counsel. To be sure, impertinent personal aremarks are sometimes addressed to the witness. These cannot burt his case, nor about they have thim. They can be best met by ignoring them, as their purpose is likely to the property of the control of the contro

variably to upset the composure of the witness. For others a pleasure. It is usually a mental combat between the questioner and witness, and the wise with tween the questioner and witness, and the wise with meas will save some of his best ammunition for this encounter. There are many clever tricks of this trade, For example, a skillful examiner will start out with a line of seemingly irrelevant questions, with the uitimate object of cornering the witness. This may be likened to the moves of a chess player who is trying to get his opponent where he can checkmate him. The sarlier in the game the witness can foresee what his ultimate nurness is, the better

"Again, it must be continually horse in mind that the cross-scammer is trying to get material for his brief, and care should be taken not to make statements which can be misconstrued. The clever expert can get into this part of his deposition a great deal of good material for his side. We are assuming, of course, that he witness is on the right side of the

"An expert witness is not a fact witness. He is not, therefore, hemmed in by the great mass of rules of evidence which surround the witness who is testifying to facts as he remembers them. The expert witness may use notes, so long as they are prepared by thin, as he need not rely upon his memory. This is because he discusses principles, quotes authorities, and sets forth reasons and conclusions, and the reliability of his memory is not brought into any such matters. Our courts have often encouraged the use of notes by experts because of the fact that carefully prepared notes facilitate the presentation of such testimony as they give, and aid in making it more logical and complete, thus enhancing its instructive valuer. Again, experts may be asked leading questions, a thing not permitted with fact witnesses.

"The patent expert differs from other expert witnesse in on essential particular. The ordinary espert witness deals almost exclusively with opinions. The value of his testimony reats entirely upon the weight of his opinion. He is asked to tell why he is qualified to have an opinion which is worthy of unusual consideration, but is not asked the reasons upon which he bases his opinion. But with the patent expert it is the reasons he sets forth, his discussions of facts upon which his conclusions for facts upon which his conclusions may be based, or of those things which may support or justify a determination, that are of prime importance. The expert's part of littigation is of undoubted im-

"The expert's part of litigation is of undoubted importance. Under present practice it is much abused. In presenting complainant's side of a case the expert testimony should be clear, concise, free from all irrelevant matter and as short as possible. Perhaps, then, the judge will read it. It takes more skill and more time to prepare a short deposition than a long one.

"There is more excuse for defendant to present more lengthy and exhaustive experting, as he must set forth every defense upon which he can rely. This makes it incumbent upon complainant to answer rebuttal the evidence presented by defendant, if it is important, and introduces the temptation to increase the record unduly and overburden the court. With such a prolixity of opinions and evidence sustaining the opinions at a thun get into the records we often find the object of the expert defeated, and instead of alight the truth of the country of the country of the property of the proper

"The tendency to overdo expert evidence is a thing which is today justly criticised. One of our prominent experts recently took up eighty pages of the record to prove that an electro-dynamic machine could be used either as a dynamic or as a motor, a point which had already been conceded by the other side. Judge Severens, in the case of the American Store Company vs. (Cereland Foundry Company, 168 *Ped.,

878, after deploring the fact that the record of this case has been overburdened by a prolisity of expert testimony, said:

textimoury, said:
It is not the previses of a whrest to advoicte the cause of the party who calls him, nor to pass upon the cheering of the party who calls him, nor to pass upon the cheering of the party who calls him, the controversy. Treesandly the party of the controversy of the cheering the cheering

"The status of the expert in patent litigation is of dignity and importance. If he is properly qualified his statements are of value to the court, and his opinions and conclusions, if supported by facts and by reasons, must necessarily have weight and influence. The expert has been called an auxiliary cicinseier, and although this term is perhaps not well chosen, it suggests the importance of therough understanding and complete oc-operation with the counsel with whom he is laboring.

"It is instruction the court desires from the expert, and therefore clear, concise and simple statements in logical order are of greater value than a great mass of more or less irrelevant matter. And when these statements are upheld by the prestigs of the men's own position and attainments, or are backed by citations from recognised authorities, the expert's testimony cannot fail to play the important part it should in patent litigation."

Smoke and Soot

A DARK cloud of smoke, with a sharply defined upper boundary, usually hovers over every large city in caim weather. In large factory towns the air is never free from smoke. No expert knowledge is nequired to comprehend the futury inflicted on the bealth of the inhabitants. This injury has rapidly increased with the development of manufactures, but, fortunately, the science and art of hygiens are developing at an equally rapid rate.

The approaching international Hygiesic Exhibition at Dresden, from whose bulletin, Hygiesia, this article is condensed, will contain many exhibits illustrating the enormous waste of fuel in improperly constructed and operated stoves and furnaces and the character and amount of the impurities which they discharge into the atmosphere. These impurities consist of unburned carbon, or soot, and of various poisonous gases, chelty carbon monoxide, amonds, and sulphurous, sulphuric and nitrous acids. The soot which, with condensed water vapor, constitutes the visible part of smoke, clogs the lungs, the poisonous gases act chemically on the blood, injure the nerves and irritate the delicate mucous membranes of the air passages and unfit them for their most important duty—the protection of the body against the sgerms of tuberculosis and

The injuries inflicted on animal organisms by smoke and soot do not, as a rule, become well marked until the injurious influences have acted for a considerable time in plants, the effect appears more rapidly Contiers, in which the leaf surface is increased by subdivision into myriads of siender needles, have a hard struggle for life in the smoky air of cities. The leaves become coated with soot, which hinders transplation and sufficeates the plant. The injury is increased by scrid and poisonous substances, deposited with the soot, or acting in gaseous form.

Numerous devices for the rational combustion of fuel have been invested. By proper construction of grates, air passages and other parts of turnaces, careful selection of fuel, rational methods of stoking, and the employment of apparatus for the absorption and consumption of smokes, it is already possible to effect a considerable abstagment of the smoke nuisance, with a corie-donding economy in fuel. There is reason to hope that the nuisance will ultimately be attirely suppressed, and that our chimneys will discharge only the final products of complete combustion, exclose diside and water vapor. Meanwhile, devices for minmining the injurious action of smoke by replicity carrying it away and diluting it largely with air possess great interest. Some of these devices, including the Wisilcentus "dissipator" chimney, will be shown at the Dreaden exhibition.

The steadily increasing employment of gas and elecricity for the production of heat and power is an important factor in smoke abatement. The comparatively few large gas works and generating plants in which coal is bursed can be located away from congested districts and can be rationally operated and controlled more easily then thousands of independent formance.

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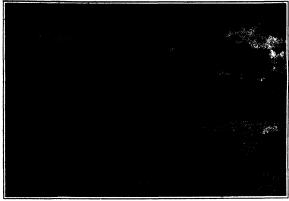
A Wonderful Dinosaur Mummy

A Relic of the Prehistoric Past

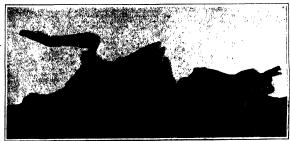
By Walter L. Beasley

MONG the recent ex-A mong the recent discoveries of the West, none is more marvelous and illuminating than the "Mummy Trachodon." In In acquiring this great "find" and exhibiting the truly wonderful specimen Prof. Henry Fairfield Osborn of the Museum of Natural History, New York, has made a noteworthy con-tribution to paleontologigribution to paleontologi-cal science and has at the same time given a most impressive exhibit to the general public. In fact, the surprising revelations which have been brought to light by a study of this skeleton furnish a new and fascinating chapter which nearly doubles all previous knowledge of the habits and life of a very remarkable group of great amphibious reptiles. important and valuable feature about this unique specimen is that it presents a complete cast, with absolute distinctness, of the hitherto practically unknown outer covering of these herbivorous dinosaurs belonging to the closing period of the Age of Reptiles. During the Upper Cretaceous Period, according to geoiogical reckoning, about three millions of years ago, these huge kangaroowater-inhabiting creatures were very abundant in western North America. They were from fifteen to sixteen feet or more in height, and measured some thirty feet in length. The skeletons, or hard parts, have been known for a number of years, having been found by Prof. Cope, the pioneer fossil explorer and sci entist, and by others. The museum has mounted in its striking Trachodon group a fine Cope speciing posture Some half a dozen fragmentary speci-mens have been found showing faint areas of the epidermis, but the "Trachodon mummy" far surpasses all the others, as it presents a nearly complete and priceless pic-ture of the pattern em-bossed upon the skin of these gigantic marine monsters. This fossil prise was discovered in August, 1908, by the vet-eran fossil hunter, Charles H. Sternberg of Kansas, and purchased by the museum out of the re-sources of the Morris K. up Fund. One of the light has been shed by this specimen is the ac-quatic life habit of these mens of their skin it

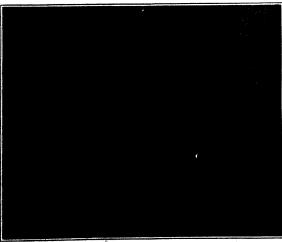
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Imaginary restoration of Trachodon in its characteristic erect and prone postures.



The "Mummy Trachodon" found in Wyoming.



stion of Trachodon, showing the pattern of tubercles. A patch of the skin impre A WONDERFUL DINGSAUR MUMMY

was spent for the most part in the water. This theory is further strength ened by the fact that the diminutive fore limb term inates, not in claws or hoofs, but in a broad extension of the skin, reaching beyond the fingers in a marginal web, which connects all the fingers with each other, forming a kind of paddle A new restoration of the Trachodon, which renders all previous ones obsolete, based on the nummy specimen, has just been made by Mr Charles R. made by MT Charles R. Knight, under the direc-tions of Prof Osborn. This strikingly shows the life appearance and the two characteristic atticharacteristic attitudes commonly assumed taken by these creatures, and especially brings out the short dangling front legs, now known to have been fore paddles From the fact that the lower side of the fore limb is as delicate in its epidermal structure as the upper, certainly tends to support the theory of the swimming rather than the walking or terrestrial function of this fore pad-

In Mr Knight's restoration one of the Trachodons is pictured in the conventional bipedal, or standing posture, while the other is shown in a quadrupedal, or walking position, sustaining or balancing the fore part of the body on a muddy surface with its fore feet. In the distant water a number of the animals are seen disporting themselves This spec themselves This spectmen has been called re "Dinosaur mummy" from the fect that in all parts of the animal "hich are pre served, except the hind legs and tail, the skin is shrunken around the limbs, tightly drawn around the bony surfaces, and contracted like a great curtain below the chest area Prof Henry Fair-field Osborn, who is the foremost authority on the subject, has suggested the following interesting the-ory of the entombment and preservation of the and preservation of the "Mummy Trachodon."
After dying a natural death the animal was not attacked or preyed upon by its enemies, and the body lay exposed to the sun entirely undisturbed for a long time, perhaps upon a broad sand flat of a stream in the low-water stage, the muscles and viscera thus became completely dehydrated, the epidermis shrank, and was tightly drawn down along all the bony sur-faces and became hardened and leathery; on the

(Continues on uses \$18.)

Curiosities of Science and Invention

Gasoline-propelled Lawn Mower

THE German government has recently bought two lawn mowers which are propelled by means of gasoline engines se mowers are used for cutting park The type of engine used is similar to that of an automobile It is connected by means of a chain to a pair of traction wheels, on which the frame of the machine is supported in addition to this there is a single wheel at the rear which may be turned to steer the Directly in front of the traction wheel are the grass-cutting knives arranged in the usual spiral form These knives may be adjusted up and down as in the usual lawn mower, and they are driven by direct connection with the

Motor Substitute for a Hand-car

HAND-CARS are now being displaced by motor cars on the leading rail-roads of the country. Through the use of these cars it is claimed that more work is performed by each man, due to the fact that he is set down at the place of work in excellent condition while with the old style car it is neces-sary for him to put forth almost enough effort for one day's work in propelling the car The accompanying illustration bash Terminal Railway which is propelled by a 3 horse-power gasoline engine. It is capable of developing a speed of 30 miles per hour on level track with five

Swimming Lessons for School Children

THE accompanying photograph illustrates an apparatus in use in Germany for teaching school girls how to swim The pupil is suported in such a position as to leave the legs and arms free to perform the motions of a swimmer. The body is hung in a wide belt, suspended from an overhead rail, while the feet are attached to a pair of ropes running over pulleys and adjustable to various requirements The pupils thus suspended are then taught how to perform the movements of the breast stroke until the action becomes almost instinctive There is a decided advantage in teaching these movements in such a way instead of in the water; for the pupil is not distracted by the fear of a ducking It is not at all easy to learn the swimming move-ments even out of water, hence the advantage of acquiring this knowledge until it becomes almost instinctive before en-

The Plumb-line in Porto Rico

A MONG the curious discoveries made by men of science in their in-numerable efforts to measure and map the earth with the least possible error is that there are places where the direction of a plumb line is not vertical Irregularities of density in the crust of the globe may produce this phenomenon. A remarkable instance in point was found in the island of Porto Rico, where the deviation from the vertical is so great that, in mapping the island, the northern and southern coast lines, as shown in the older maps, had each to be moved inward

Mowing Submerged Weeds

MANY of the lakes and creeks of Germany are so affected by the growth of weeds in the shallower waters, as to interfere seriously with the catching of fish by means of nets In order to clear the marshy bottoms of vegetable growth a weed-cutting apparatus has been invented. This is shown in the ac-



Gasoline-propelled lawn mower.

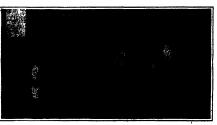
Power-driven eclesors-grinding origination



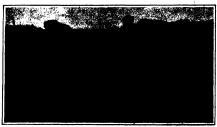


Motor substitute for a hand-car.

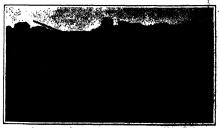
Pipe made of red gum tree cond



Teaching school-girls how to swim.



Weed cutter with the catting frame raised.



Mowing weeks from the bed of a creek.

ives like those of a m e bottom of the lake a knives are operated by m wheel to cut the weeds. usually propelled by means of long p By operating another hand wheel the frame may be lifted out of the water and swung to the position shown in one of the photographs.

Power-driven Scienors-grinding Outfit

N France even the soi In France even the someon grinder for relieving him of much of his labor in sharpening scissors, knives and other tools. The accompanying engraving shows such a motor-driven grinder in service on the streets of Paris. It is operated by a small single cylinder air cooled engine, mounted on the frame under the grinding table, the outfit is propelled by hand as a two wheeled cart.

Eucalyptus Tobacco Pipe

N South Africa, where many species of Australian Eucalypti have been sucsfully naturalized, a curious use has been made of the cones of the red gum These are of fair size and when the seeds have been shaken out resem-ble a cup in shape. It occurred to some ingenious person that the cones would make very good pipe bowls. A hole was bored in the base of the cone, and a piece of slender bamboo selected. When the two portions were joined together a very serviceable and nevel pipe was the result. An experienced smoker decis the Eucalyptus pipe to be very agreeable in use, as the natural fragrance of the cone imparts a delicate fragrance to the flavor of the tobacco.

Canal Improvements in Germany

THE question of placing a tax upon navigation on the Rhine is being disation on the Rhine is being discussed in Germany, in order to meet the expenses of canal building and like pub-lic work. However, as the lower part of the Rhine runs through Holland, and that country will not admit the idea of such a tax, some other measures must be taken. It is thought that the solution of the problem would be to transform the Rhine into a purely German river as far as the sea. During a certain time it was considered that the best point to shoose for the port at the mouth of the river would be the port of Emden, as the Dortmund-Ems Canal ends at this point, and this canal connects with the part of the Mittelkanal which passes from Dortmund to the Rhine. However, the port of Emden has not received the development which was expected, and the trafof the Rhine-Westphalian region does not follow the direction of the mouth of the Ems. As regards the proposed canal, it appears that in former times the khine was connected with the Ems by a pranch which bore the name of Rastern Rhine, but this branch no longer exists. The most recent project calls for the construction of the canal so as to restore the ancient branch of the Rhine, and it would start from Wesel, following alo the Prussian frontier and connect with the Ems at Hannikenfahr. As it would run across a flat country for the most part, the construction would not present any difficulty, and as the land has but any difficulty, and as the land has but little value in these regions, the cost would not be high. Moreover, the proceed cand would meet no locks along its course. Owing the the notice of the enterprise, however, the works would have cost less them. \$55,000,000.



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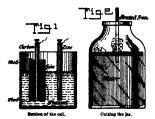
The fiding of the Home Laboratory will be gied to receive gestions for this department and will pay for them, pre available.]

A Seven-cent Battery

By W. J. C.

An electric battery costing but seven cents can be made as follows: Procure a large glass or earth-A made as follows: Procure a large glass or earth-enware, far holding at least one-half gallon. If the top is not level or tapers, a glass jar can be cut level by the following means: Pour water in through a funnel to within one inch of the place where the cut is desired. Then, still using the funnel, slowly pour in linseed oil up to the level of the cut. A red hot place of iron plunged vertically into the oil will cause rack at the level of the liquid and leave open top jar suitable for the battery.

All the materials nec sary for the battery are s



and better

piece of sinc, a piece of arc light carbon, two circular pieces of wood about 3 inches diameter by 1/2 inch thick, some fine powdered coke, and some fine nel. The illustration shows the method of assembling the parts. The wood has a hole just large enough oing the parts. The wood has a note just raye enough to admit the carbon. The finnel is fastened, as shows, to the wood, forming a bag around the carbon in which the coke is packed tightly. The zinc and carbon can be held by any suitable means in the jar, and wires may be attached to the ends. The jar is filled about two-thirds full with a solution of 3 ounces of salamoniac to 1/2 gallon of water. The battery will be found very efficient owing to the porous carbon element

Home-made Anemometer By Frederick B. Gilbert

Since the introduction of the acroplane the anemometer has become very important in measuring the velocity of the wind before and during flights.

The instrument as sold by dealers consists of a set of revolving cups or vanes which actuate a clock train and thus move hands around dials which indicate vel ocity and pressure. This instrument is rather ex-pensive, so that amateur aviators, or other people who

The second secon

have occasion to use one do not feel that they can afford it. The anemometer described be-low can be easily made by any one presenting mechanical abil-ity, and, if carefully constructed,

should give good results.

It consists essentially, as will en from the figure, of a affixed to a shaft which is Plate ag connected to a spring bilance.
The wind blowing on the face of the pinte exerts a pressure which is transmitted to the which is 'transmitted to the pring helpico and thereog in-divided,' Two interchangeshie hose gitism of very light the tree gitism of very light the notes square for light wind inches square for light winds inches square for light winds and the circle 12 inches square are heavy spinds. The skelt is logisted, but and altered to the hough state mostly in the camera. It should be so meanth as pen-changes and the state of the logisted winds. The should be the state of the logisted winds. The should be the state of state of state of state state of state s

working parts should be constructed with an eye to making them nearly frictioniess. The bed of the instrument is about 10 inches long, 2½ inches wide, and % inch desp. The uprights are 3½ inches high and the rollers ½ inch indiameter. Alongside the shaft and attached to the bed is a strip of wood cut so as to receive a paper scale over which a pointer on the shall travels. The spring balance is attached under the shaft and arranged so that its action line will be parallel to the axis of the shaft. The best spring balance to use is one reading to ten or twelve pounds in as small ounce divisions as it can be obtained. The whole may be placed on a tripod, an old camera tripod answers very well, or it may be fastened to a stake. If it is desired to keep it constantly working a vane may be added to keep it faced into the wind.

The table below has been supplied by the U Weather Bureau and gives the wind pressure in pounds for velocities from 5 to 90 miles per hour. Indicated velocities (velocities indicated by an anemometer of standard type) are given instead of true velocities. The difference is considerable. A

Wind Pressure (Pounds per Square Foot).

Ind)- cated veloc	+ 0	+ 1	+ 8	+ 8	+ 4	+ 6	16	+ 7	+ 8	+ 9
			12.8	1 68 8.14 6.07 7.40 10 1 18 1	1 76 8.88 6 27 7.64 10 4 18 5	1.90 8 50 5 51 7 88 10 6 18 8	0 858 9 04 8 67 5.79 8 14 10 9 14,1	8,19 8 87 6 98 8 48 11 2	1.06 8 84 4 04 6 18 8 69 11.6	0 308 1 16 2 48 4 94 6 40 8 95 11 9 15 1 18 8

To obtain the true velocity of the wind, the following formula may be

P = 0 400 B SV

- presure in pounds, avoirdupois,
- surface, in square feet,
- corrected velocity of wind, in miles per hour,

wind of 5 miles per hour indicated velocity would have an actual velocity of 5.1 miles. For 6 miles per hour the velocities true and indicated would be the same: but above this velocity the standard anomo meter readings would be greater than the true wind velocity. For instance, 50 miles indicated would be 40.8 actual, 70 indicated would be 55.2 actual, 90 indicated would be only 69.2 actual.

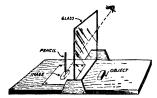
By means of the foregoing table or the formula we can now graduate the anemometer to give indicated or actual wind velocity For a given pressure on the spring balance we mark the corresponding velocity on the scale. Since we have two face plates of dif-ferent area it will be necessary to graduate two scales, one above the other, making a reduction for the twenty-inch plate to a square foot surface. The best way to make the scale is to lay off with India best way to make the scale is to lay or with india-ink on a strong plece of paper a scale with divisions equal in length to the divisions on the spring balance and to mark these divisions velocities instead of pounds. This division may be done with a pair of However, the dividers cannot be given a setting of the smallest division and then placed upon the paper and the scale laid off by walking them along, for when the end of the scale is reached it will be found to be far from correct with the one on the balance. The most accurate way is to lay the balance. the total length of the scale, then if it is a tenpound scale to lay off the five-pound mark in the middie, next the two and one-half-pound marks and so on down to the smallest divisions; thus the errors will tend to be self corrective. The scale is then glued to the instrument and covered with a coat of varnish to protect it from the weather.

It might be asked why a plate a foot square is not used exclusively, thus obviating the trouble of making changes and graduating two scales. is, as may readily be seen from the table, that for light winds the instrument would not be delicate enough. For instance, a wind of 5 miles per hour produces a pressure of only 0.104 pounds per square foot, or 166 ounces, a pressure to which the instrument would not readily respond if only one square foot of surface were acted upon, whereas if a plate 20 inches were used the balance would read 4 62 ounces, thus giving an appreciable displacement of the pointer and reducing the error of small readings On the other hand too large a plate has the disadvantage of cxcoeding the limit of the balance in heavy winds

Drawing Solid Objects with a Reflecting Apparatus

By W. R. Inghram, M.D.

THE accompanying engraving depicts a drawing apparatus that may be familiar to many. It consists of a pane of glass set upright in a groove in a



Drawing an object with a reflecting apparatus.

board A picture on one side of the glass, due to reflection, appears to cast an image upon the other side of the glass By looking at this image and at the pencil through the glass a copy of the original can be made, the drawing, of course, being reversed A drawing of this copy made in the same manner remedies the reversal

It may not be generally known that the image of a solid object thus reflected is as easily traced. This idea will be of special value to an inventor who finds it difficult to make a perspective drawing of his model or some intricate parts of it. The method will be found much less troublesome than making a pho-

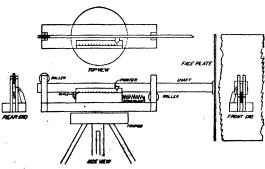
In making a tracing by this means it will be found of great advantage to have a bright light on the picture or object to be drawn and a piece of cardboard arranged to shade the drawing paper.

A drawing is more quickly and easily made by simply marking the intersections of the different lines, and directions of curvatures, etc., after which the rest of the picture may be filled in with the aid of a rule If a very thin glass is used the double image, due to refraction, will not be confusing.

As a interesting experiment, take two blocks of identical size (so that reversal does not interfere) One of the blocks may be placed to coincide with the image made by the other

It would be interesting to hear from someone with a knowledge of clay modeling as to whether the model might be duplicated in this way (re-versed, of course), excessive material being removed until the surface coincides with the re-flected image of the object being

In making drawings in this way the writer several times caught himself reaching for the image instead of the real object, and was surprised to find his fingers closing on thin air. It was rather disconcerting until the mind had had time to grasp what had happened.



cities by determining wind pro

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

A Coal Dust Engine By R. W. Crowly

THOUGH vet in the experimental stage, the regenerative gas engine which burns coal dust as fuel has given results that promise well for larger gines of this type. As the working

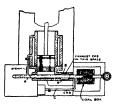


Fig. 2.—Plan view of the coal dust engine

principles are so entirely novel, there is difficulty in finding a term which ex actly expresses the nature of this sim ple engine It is perhaps best named after its inventor, Mr. A. M. Low, for the Low engine is quite as distinct a type as the Diesel engine, though of course the comparison between these two names must not be taken to indicate any resemblance between the two engines. Setting out with the idea that he should find a method of reclaiming some of the waste heat of the gas a self-contained producer-gas plant and engine. In was engines something like 80 per cent of the heat available in the cylinders is wasted either in the cooling water or in the exhaust. Very little of the heat is actually converted into mechanical energy Regarded as a heat engine, the gas engine, though better than steam engine, is still very wasteful The best heat engine is the Diesel, which has a thermal efficiency between 35 per cent and 40 per cent, and it is extremely doubtful whether doubtful whether under any circumstances that high figure will ever be improved upon

Low's working principles provide for the consumption of a fuel which is almost universally cheap; namely, coal He has run his experimental engine on a consumption of about four pounds of coal per B H P hour evident after the engine has been described in detail, a much higher effi-ciency would be obtained with larger engines and therefore it is not too op-timistic to state that these engines will find an important place for themselves when designed upon a commercial basis More than five years have already been spent in bringing the experimental gine to its present stage of development and owing to the many alterations that have been made, many fittings being of a comparatively temporary character, the engine is not at all suited for accurate efficiency trials A 40 horse-power engine is now in course of construction, and will shortly be available for a complete series of tests.

Referring to the illustrations of the experimental engine, Fig 1 shows a view taken just above the back end of the cylinder. The fly-wheel is visible, the crank can be seen partially, but the con-necting rod is entirely hidden. In so far as the moving parts are concerned the engine differs in no way from the nary horizontal gas engine. The distinc-tion is in the regenerative parts The inventor takes up a portion of the waste

heat by means of a series of tubes passing through the compression space and arranged with one end projecting, as shown in the illustrations, into a which contains coal in the form of dust while the other ends of the tubes are

When the engine has been started and is running, the tubes are heated to a dull red. As the fuel passes through the first portion of the tubes it becomes heated, the intermittent combustion which is taking place in the cylinder on each orking stroke giving regular increments of heat which maintain the tubes at a working temperature. The fuel is heated sufficiently to drive off most of the coal gas. The tarry and carbonaceous products pass along farther, until, when they reach the part of the tube surrounded by the combusion chamber, they are at a high temperature. In each tube on the I side is fixed a pipe from which steam, taken from the facket, and air. can be injected through the hot coal. In this way water gas and air gas are pro-duced. In the tubes and just outside the coal box a second set of pipes is fitted. passing over the water seal and thence directly to the inlet valve. Thus, as soon as the coal dust is formed and the cock opened, the mixture of coal gas. water gas and air gas is drawn into the cylinder with its mixture of air, and fired in the usual way,
Ordinary bituminous coal broken up

into small pieces is put into the actual container indicated in the general view of the engine. Coming away from this coal container in the direction of the engine are four pines (A in Fig. 2). On leaving the coal box, they pass first of all through an extension box B of the engine, then right through the combustion and out again on the other side, and is fed into the pipes A by a bevel-driven archimedean screw feeder (Figs 2, 3), the speed of the drive being variable. The function of the water seal is that if porchance any coal dust should pass along to the end where the tubes bend (Figs 2, 3), downward, and not be gasified, it will fall into the water and may thus he removed when desired. The pipe from the inlet valve of the engine connects to this chamber, as also do the small pipes C, which communicate with the pipes A. Through the former pipes C the gas is of the combustion chamber increases wit

the latter, A.
Simple though the whole engine nears when described and illustrated, the fact that it runs with such a low fuel consumption as four pounds per B. H. P. hour is not to be doubted. In this connection Mr. Low writes: "I must noint out that the engine is bound by its very nature to be efficient. Not only is 'waste heat used, but the engine can be run very hot and with a high compression without any pre-ignition (the combus tion chamber of the engine illustrated is asbestos lagged), and as the gas is kept comparatively cool by mixing, we have the best conditions of high thermal effi

"Large single engines can easily be built on this principle, as the combus tion chamber surface can be increased and cooling obtained to any desired extent, for it is possible to run with th really hotter than the tubes injecting the steam under pressure. The fuel temperature is high and the coa is cracked so quickly that all by-product be passed through the engine over the water seal and discharged, the exhaust being slightly white and rathe pungent. After weeks of running no trace of any tar or other matters can be found, neither is any pitting of valveto be detected."

Safety is another point on which this flash engine scores, as there is never any explosive gas present except in the engine itself, and there is nothing to cause any danger at all, for the fuel is consumed as soon as it is made. The engine is extremely flexible, which is a point of no small importance where en gine work is concerned; an increase of power of about 15 per cent can be oboff the steam and air supplies and run ning the coal pumps faster, while admit ting more extra air, thus making the largely increasing the effective pressures

Of course, the important fact which must be mentioned in order to satisfy curiosity is that the engine works. A very eminent English engineer who saw the engine before it had run, made the curious remark that if that particular engine would not work, the bigger en gine would certainly work explanation is, of course, that the volume

drawn off from the hot coal contained in the cube of the diameter, while the co ing surface of the walls increases only with the square. Dealing with the larger engines, therefore, one obtains a fer greater proportion of combustion volume; from which it follows that a bigger tube heating surface can be obtained. is a very curious feature of the engine that the regenerative process becomes more and more advantageous the bigger the engine power. And as it is pre-

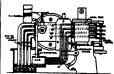


Fig. 3.—Rear elevation with parts al-

cisely in the treatment of the heat that difficulty is obtained with big gas engines, this is a very important feature. Remembering how the Diesel Remembering how engine was scorned upon its first appearance and noting the great vogue it has now obtained, one can safely foresee that the Low engine is destined for a great future.

Proceedings of the International Union for the Protection of Industrial Property

HE Conference of the International Union for the Protection of Indus-Trial Property met in Washington on May 15th, for the purpose of consider-ing amendments and revisions to the Treaty of Paris of 1883. Most of the nations belonging to the union have submitted propositions, and all of these will be considered during the sitting of the conference, the sessions of which pected to occupy about six weeks. meeting place of the conference is the New Willard Hotel, which placed its ball rooms and a suite of offices at the disposal of the union.

One of the principal disappointments of the conference was the inability of M. Henri Morel, Director of the Inter national Bureau at Berne, to attend. He was prevented by illness from making the long journey from Switzerland. The vice-director, Mr. Leon Poinsard, ar-rived in Washington on the 6th of May and at once opened the headquarters of preliminary meeting of the United States delegation was held in the office of Mr Moore, the Commissioner of Pat-ents, on the 13th instant, and a complete understanding was reached as to the policy of the United States toward the projects that are to be advanced by the conference. The President signed commissions giving the entire delegation plenary powers, as this is what is known s a "diplomatic conference."

The procedure of the confer most formal The delegations are ar-ranged in the alphabetical order of the names of their countries, French being the language used. This puts Germany, the language used. This puts Germany, or Allemanne, at the head of the list. The delegates are seated at the conference in the alphabetical order of their countries, beginning on the right hand of the presiding officer, without distinction of union and non-upien countries. The acting director of the International Bursau couples the last seat, thus being on the left of the president. Mr. Mootes.

The second secon

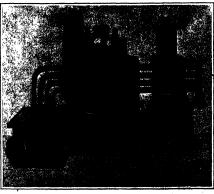


Fig. 1.—General view of the Low coal dust engine from the rear end of the cylinder.

changed the delegation represent change in which the conference ecoupled the chair at the open After an address of weling massing, arrer an address or wel-onies by the Secretary of State, Mr. Sthou, the first business before the con-gress was the election of a permanent president. It being the custom of the conferences to select for this high omesome retired diplomat, Mr. Henry White, formerly United States Ambassador to France, was designated by the United States government. The election of other officers, including a vice-president, followed, and the list of members of the board of secretaries was approved, as were also the rules designed to specify the procedure of the conference. All this was furnished by the International Bureau. Upon M. Poinsard and his staff, consisting of MM. B. Frey-Godet and Ed. Waelti, secretaries, and M. Leuis Poinsard, private secretary, devolved the duties of reporting the ses-sions and keeping the records. The daily proceedings of the conference are printed each day in French and distributed to the delegates.

A list of the delegates appointed up

to date was printed in the SCIENTIFIC AMERICAN of the 6th instant. Since then, Austria, Hungary, Portugal, Ger many, Sweden, Tunis, France and Italy have designated their representatives. It was at first announced that Italy would not participate in the conference, but evidently the Italian government concluded that it would be to the best interests of that country to send deloalthough the International Exposition at Rome and Turin and various other congresses drew heavily upon the available scientists and experts. The Italian delegation consists of Nobile Lazzaro dei Marchesi, Marchesi Negrotto Cambiaso, Connselor of the Embassy at Washington, Engineer Emilio Venezian, Inspector of the Ministry of Agriculture. inspector of the ministry of agriculture, Commerce and Industry, and Dr. Gio-vanni Battista Cessato, Commercial At-tache of Embassy at Washington.

The French delegation is composed of M. Lefere-Pontalis, Counselor of the Embassy at Washington; M. Breton Director of the International French Property Office: M. Michel Pelletier, reporter of the Technical Committee of the National Industrial Property Office, and Mr. Georges Maillard, President of the International Property Association, For the Protectorate of Tunis M. de Peretti de la Rocca, First Secretary of the French Embassy at Washington, will

The King of Sweden has appointed his Minister at Washington, Count Albert Ehrensvard, to represent that nation, and Germany sent Dr. Haniel von Haimussen, First Secretary of the Embassy Washington; High Privy Councilor of Government Robolski, reporting coun-selor of the Imperial Office of the Inand Prof. Dr. Osterreith, Secretary General of the German Union for Protection of Industrial Property. the Protection of Industrial Property.

The Portuguese delegation is composed
of Viscounte de Alte, Minister at Washington, and Señor Urnesto Madeira Pinto, General Secretary of Public Works, Commerce and Industry.

The delegates of Austria and Hungary form two distinct bodies and vote sep-The Austrian delegates are Dr. arately. arately. The Austrian delegates are Dr. Paul Chevalier Bock von Mannagetta und Lerchenau, President of the Im-perial and Royal Austrian Patent Of-Privy Councilor of His Imperial Royal Apostolic Majesty; Chevaller Phillipp von Stahl, Ministry Councilor of the Imperial and Royal Ministry of Public Works, and Doctor Emanuel Adler, Secretary of the Imperial and Royal Ministry of Public Works. For Hun-Range to delegates are Dr. Elemer von Rengery, Ministry Councilor Royal Hungarian Patent Office, and Dr. Con-sistent Karner, judge in the Royal Hun-

ngton, Baron von Hengelmüller, does not appear in the conference as a dele gate, but is instructed by his govern ment to act as general repres when international agreements, binding upon the participant States and result ing from the deliberations of the con nce, should come up for signature.

The Spanish delegation will be com posed of the Minister at Washington Senor Don Juan Riano y Gayangos, and Don Juan Plorez Posada, Director of the School of Industrial Engineers at Madrid. Brazil will be represented by Mr. R. de Lima e Silva, Charge d'Affaires of the Embassy at Washington. The Minister of Bolivia at Washington, His Excellency Ignacio Calderon, will represent his country at the conference

Peru has appointed Mr. Emanuel de Freyre y Santander, First Secretary of the Legation at Washington, as delegate, and Liberia is represented by Mr. Ernest Lyon, Consul-General at Wash-

ington. Owing to usgent parliamentary duties regrets were sent by Hon Sydney Fisher, Minister of Agriculture, who is also Commissioner of Patents, and who had hoped to head the Canadian delegation, as announced. In his place was Mr. P. E Ritchie, Registrar of Trade Marks and Copyrights of the Dominion Government.

Inasmuch as the deliberations of the conference are secret and the final texts of the treaties as amended are not given out until ratified by the various nations, it will be impossible to set down at present just what is being accomplished on behalf of the inventors and manufacturers of the world, but a still closer international amity with regard to th protection of industrial property is the inevitable outcome of this important conference, in which so great an interest is of Carpenter vs. Skinner there came on taken by the civilized nations of the globe for hearing in the same court, the case that they have sent as representatives their most distinguished savants and men high in the realm of science and diplomacy.

Notes for Inventors

An Early Electric Automobile,—An early electric automobile is illustrated in the French patent to Grounelle, dated 7th. 1852. The illustration February presents a large four-wheel vehicle similar to a coach, with a number of trans-verse seats and without a top. Power is applied to the rear axle through diminishing gears from an electric motor of type, the current being furnished from a large primary battery (sulphate of copper) in a box at the front. For steering, the front axle turns about a vertical axis and a horizontal gear on the axic is meshed by a pinion on the lower end of the steering shaft which extends up and is provided at its upper end with a turning handle at the driver's seat.

Patents on Current Tape.—Three patents, 990,418, 990,419 and 990,420, have been issued to the Benjamin Electric Manufacturing Company, Chicago, Ill., assignee of Reuben B. Benjamin, for current taps for use in connection with lamp receiving sockets.

A Poet Patentee.—A gun was pat-ented in the year 1718 in England to James Puckle, who termed it "A de-fence," and dropping into verse, says, "Defending King George, your country and laws

If defending yourself and Protestant

tipp von Stahl, Ministry Councilor Puckle was evidently a religious enangement of the imperial and Royal Ministry of Puckle was evidently a religious enangement of the Commission of the Commis

cylinder were to be revolved by a hand crank, being successively brought into registration with the barrel. The carriage or mount provides for the revolu-tion and elevation of the gun proper, and appears to be well adapted for use in shooting flying machines. It is worthy of note that the mount of this early gun of 1718 more nearly approaches the car riages recently produced than those pat-ented twenty or twenty-five years ago.

Legal Notes

An Action at Law for Infringement.— An interesting case is coming on for trial at an early day in one of the New York districts, in which the owners of an electrical patent have brought suit on th aw aide of the court for damages for infringement of the patent and the case will be given a trial before a jury.

Norling vs. Hayes: An Important Decision.—In the case of Carpenter vs Skiner decided by the Court of Appeals of the District of Columbia, January 3rd, 1911, the court said: "It appears from the uncontradicted testimony of Skinner that ne showed his invention to Carpenter who had ceased manufacturing under his pat-ent. Within about two weeks thereafter Carpenter filed his reissue application with claims dominating the device of Skinner which was not an infringement of the patent. It is well settled law that to warrant the valid reissue of a patent, there must not only have been a mistake by the patentee, with no want of rea-sonable diligence in its discovery, but also that no third person has in the meantime acquired the right to manufacture and soil what the patentee has failed to claim For the reasons given the decision will be reversed." Shortly after the decision in the case

of Norling vs Hayes, which the court "In the decided May 1st, 1911, saving present case, a finding that a patent ought not to issue to Hayes, notwithstanding he is the prior inventor, in no way af-fects the sole question involved in the interference, namely, the question of priority; in other words, such a finding would not entitle Norling to an award of priority Had the Commissioner ruled that the structure of each applicant con-tained patentable features, and that there was no interference in fact, and we had sustained the latter ruling, could it be maintained that either party would have the right, as against the other, to urge the bar of public use? Manifestly . . . It should be remembered not. that this is not an infringement suit, but a proceeding under a statute which provides for the determination of a single issue, that of priority of invention.

"We conclude, therefore, that we are without jurisdiction in this proceeding to pass upon the question suggested."

In this same case of Norling vs. Hayes the court referring to Skinner vs. Carpen-ter says: "In that case . . . upon appeal to the court, the question of in-tervening rights having been raised below, and relied upon here, we ruled-Carpenter not being represented—that in Carpenter not being represented—that in the circumstances of the case, Carpenter was not entitled to a release of his patent and reversed the decision of the Commissioner. We did not, however, award priority to Skinner. The court then proceeded to consider the matter de novo, and said concerning the mat-ter of intervening rights as above quoted

RECENTLY PATERTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

BOOT OR SHOE HEEL.—N. B. ARNOLD, New York, N. Y The aim of this inventor is to provide a heel having a tread partly made to provide a heel having a tread party made of leather and party of rubber to prevent the wearer from silipping, to relieve the Jar Inel-to the treatment of the rubber portion of the tread and focation of the rubber portion of the tread and location of the same at that part of the heel usually worn out first.

SKIRT MEANINIMON DEVICE—RALLIE M.

SKIRT MEASURING DEVICE --MALLER M. ALLEN, Peplar Bing, Mo. An object of the invention illustrated herowith is to provide a device by means of which a skirt may be so trimmed that the bottom of the garment will be at the same distance from the ground all



SKIRT-MEASURING DEVICE

around the edge. Means provide that the skirt may be held in position while being marked A further object is to provide a device by which the marking of the skirt may be ren-dered accurate. Mrs. Allen makes use of a perforated hosp for the perforations of the perforation of the control of the per-guide for the chalk or other marking naterial

PLANTER - W C THOMA, Oldess, Del. This corn planter is adopted to plant one or more rows or hills of corn at a uniform depth at each trip across the field, and to level and pulverize the graund along each row It is a conveniently operation and simple mechanism for raising the turner, formers and seed coverers from and lowering them to the ground operations. iowrere from and lowering them to the ground PIANO CANING -II Poultans, New York, N Y. The object of this invention is the provision of a new and improved casting, in which the keybed and keys held theron can be readily removed from the piano frame, to allow of conveniently moving the piano in sec-tions from one place to another, especially sing narrow lattle or up and down narrow staffways, etc.

CANE STRIPPER AND TOPPER -H T. CAND STRIPPIN AND TOPPER—H T. BEATERMAN, New Ordens, L. in this investion the improvement relates to a device for use in artipoints the levers from sugar cane and removing the tops or topping the same. This device is disclosed in this case as being connected with the mechanism for delivering the came thereto as it is directly cut from the plant in the ground.

point in the ground
ANCHOR BOARD FASTENER, Radd E.
Romins, Hastings, lowa The invention pletured in the illustration is an improvement in
corn crib constructions, and has for an object
to provide a novel construction of what may



The Earning Power of Your Money

You Get 3% to 5% on Loans and Bank Deposits. The Borrower and Banker Make 15% to 80% and Up. The Following Article Tells You How To Get What They Get.

Who is Using Your Money?

mg Article Iells You Ield

Who is Using Your Money?
In these days of struggle to meet the
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than over leading to the the demands of respectability and the high
than over leading to the demands of the thin over leading the thoughtful
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First mortgages upon well coasied
that offer possibly five per cent command
much of the money More, however,
stays locked in safe deposit vaults or
is invested in Government bonds, while
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What is done with your savings after
you by a deviable mortgage that runs,
any, for ten years, or after could
The man who gives the mortgage and
pays you the four or five per cent
doesn't do it for fun, nor for love,
need the safe of the safe of the safe of mere good chearedness. That money
must be made to earn the interest that
is paid to you, also the cost of handling
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two items it must earn a very respectation of the profit for the man or bank
handling it And as you hold the manmortgage, he would inclinally take
be would nossibly lose his property;
neither will the bank take any long
chances with your money, therefored it as
plain to ree that the money you own as
proper hands, is made to earn far more
than the little mite of three per cent
bank interest paid to you.

What Your Money Earns
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What Your Money Earns

What Your Money Earns

How can the man who borrows from
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How to Get Full Earnings of Your Money In the wonderful Bitter Root Valley

--by many called the American Garden of Eden—the prize fruits, apples, char-ries, etc., grow in such abundance and of such remarkable size and luscious-

Suppose a particular piece of land is made-capatio of producing each year a net homes requist nor larger than the original cost of the land and all development and improvement, which ings of this land each and every year, or only 6 per cent. Interest for handing year money for more case which you will you many hope the real create and rouge the larger reward, a return and the contract of the contract of the con-tract of the contract of the contract of the late of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the con-tract of the contract of the contract of the contract of the con-tract of the contract of the contract of the contract of the con-tract of the contract of the contract of the contract of the contract of the con-tract of the contract of the con-tract of the contract of the contract

he can eaply a similar income annually?

The answer is clear, but there are thousands
of people who stick to the 5 per cent basis besause they don't know how to safely perform
the other transaction and if told how and where
it can be done, their timilarly in many cases
would still inter them from setting, over though
they had every protection represented by a first
they had every protection represented by a first

It is on account of this peculiar condition with money awars that a corporation has been formed by superineced and relatible near through which they can invest their funds and eskey what is rirectally the protection of a first mort-gage and yet receive in place of a low rate of interest the total profits which their money can be made to earn for them.

The Commercial Orchard Company of Montana has selected 500 acres of the "banch" land in the heart of Bitter Boot Valley, from whence come many of the fancy fruit—apples, cherries, etc. you see displayed in the best markets, and much of which is shipped abroad.

much or which is somplyed accorded.

The particular land selected is presonned by authorities the finest for the purpose in the entire ratiop. As quickly as possible, the entire 200 acres will be set to such fruit trees as will produce quickly, the varieties of fruit for which a permanent demand exists and which command the highest prices.

Prory detail of the work will be under the superstant of thoroughly experienced herein the treatment and the result of the property and the result of the property and the result of the property of the prope

sting.

While it is proposed to operate this enterprise
is which, each investor has the advantage
is who as the proposed to the control of th

Absolute Safety

permanent vaine of such property and the uss profits it yields, is attracting the st-of those who wish their Independence d and the man or woman who can own ten acres has no cause to worry for the

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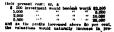
Profits and Increased Valuation

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Investors Relieved of Personni Care

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A Rare Investment Opportunity

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Vacant Regions of the Milky Way

Vaccant Regions of the Milky Way
(Ossiemed from possion)
part of this description is true enough,
according to Prof. Barnard, for this star
is in one of the most remarkable of the
blank regions of the Milky Way. Little,
however, did Sir John dream when he
spoke of the "intensely black ground"
that Rho Ophiuchl was really the central point of a strong condensation of one
of the most remarkable nebulse in the entire heavens.

the mater semantage acquires in the estitle havens.

The havens, pars this part of the sky stracted the attention of Prof. Bernard, the stracted of the

scarcely an equal for interest in the en-tire heaven. To all appearance, the great nebula is located in a hole in a very dense part of the Milky Way. The most singular feature, however, of the chasms visible in the Milky Way, is the presence within them of two grada-tions of obscurity, resembling the appar-ent blackness within the marginal un-

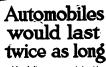
ent blackness within the marginal um-bre of sun spots. The conviction is thus enforced that the Milky Way in the neighborhood of Rho Ophiuch rests upon a far-reaching stratum of nebulous mat-ter. Yet in regions thick with stars, such as are found in Ophiuchus and Scorplo, vacancies can be found within vacancies. "These regions," to quote Prof. Barnard. "These regions," to quote Prof Barnard, "seem veiled over with some sort of ma-terial in which occur blacker spaces, as if all this part of the sky were involved in a this, faint, nebulous sub-stratum which partly veils the blackness of space be-yond. In this, apparently, occur rifts and openings giving us a clear view of space."

It is, undoubtedly, by careful study of photographs of star-denuded regions, such as those taken by Prof Barnard at the Lick Observatory and in the clear skies of Mount Wilson, California, that we can obtain some idea of their peculiwe can obtain some idea of their psculi-artites which have an important bearing on the structure of the universe. These vacant regions are not merely curiosities of the sky, but actualities of the utmost interest, and as well worthy of study as the nebulæ with which they seem in many instances so intimately connected

many instances so intimately connected in fact, the connection of nebulae with vacancies, and the apparent blending of the outer portion of the nebule with the darkness or consching really tampible, is an extremely important feature. Prof. Barnard is of the opinion that it may some day develop facts of the greatest importance in explaining the real structure of the beavens. For this reason, he is endeavoring to locate all these vacant regions of the sky, and to make long expoure photographs of them. In addition to the extraordinary regions of Ophiuchus, Scorplo, and Sagitarius aiready mentioned, he has succeeded in securing a photograph of an extraordinary region of a photograph of an extraordinary regions of particular size of the stance of the st mentioned, he has succeeded in securing a photograph of an extraordinary region in Taurus. Narrow, vacant lanes tunneling a nebulous groundwork, seem to actually exist in this region independent of the stars. Besides the lanes, the photographs show a large nebula apparently in a hole almost devold of stars, from which one of the lanes extends several degrees to the southeast.

which one of the lanes extends several degrees to the southeast.

Only a small part of the nebula is bright, the rest being feeby luminous like the nest being feeby luminous like the nest being feeby luminous like the nest being feeby luminous and feet lanes may be the major portion of the nebula now dead or non-imminous. The picture conveys the idea that this non-luminous portion of the nebula "actually causes the apparent vacancy by cutting out the light from the stars." At any rate, this is what the picture suggested to From. Starand, though he remarked the light from the stars." At any rate, this is what the picture suggested to From. Starand, though he remarked the light from the stars. The star is the superior of the star is the star



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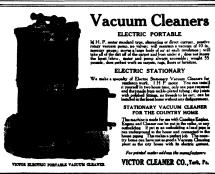
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ith a phenomenon that may not be ex-ained with our present ideas of the meral make-up of the heavens."

A Great Obelisk

(Consistent from page 500.)
where it stood upon the "Spinan." It is said to be the only menument in Bome never overthrown. It had been a Here-lean job to get it there, but now, believing that it might be utilized to support a great cross as an impressive symbol of Christiansty in a move against the pagenistic relies of Rome, Pope Sixtus V. had it removed from its foundations in the Circus Neno to be set up in the great piasse in front of St. Peter's, under the direction of Domenice Fontana, and this master-workman was threatened with death should be fail to carry out his plans!

his plans!

The transference of the tremendous block of stone was accompanied by some remarkable ceremonies, and an interest that was full of dramatic, almost tragic, intensity. It was placed on great rollers that had been carefully prepared and tested. Fontana superintended every detail in the lowering of the shaft, that was much more easily accomplished than was much more eastly accomplished than the raising of it, as you shall presently see. And well might the task prove strenuous to Fontans, for was not there the penalty of his head should he fail? Eight hundred men and one hundred and fity horses were employed in the transportation, and thousands of people watched every moment of its progress. All the preparations for holdring the shaft when it finally arrived on the plazes were made with great care, and completed with much solemnity. Every possible expediency seemed to have been considered; and indeed, so far had everything been provided for, that the Pope considered; and indeed, so far had every-thing been provided for, that the Pope issued an edict threatening death to man, woman or child who should utter a single word or manifest any excitement while the stone was being lifted into place, so fearful was he lest the slightest diverting of attention from the work, or annoying agitation by those surrounding it, might

Forty-six huge cranes had been put in place, at various points reckoned with skill and ingenuity. When all was ready the great square was covered at all sides, stently beyond the working space, by st concourse of people. The neighsufficiently beyond the working space, by a vast concourse of people. The neigh-boring housetops were also occupied, and Pope Sixtua and his officers of state and government held a commanding position.

Never had a greater crowd assembled a Rome. The silence of it was so awesome that there seemed to be some-thing portentous and ominous to a degree of terror. Finally there appeared to be a concerted movement among the workmen, and the great hempen cables of the cranes were seen to tighten and then to move—and then the stone mon-ater began slowly to rise. Everything then to move—and then the stones mon-ster began slowly to rise. Everything seemed to proceed so victoriously that at last there appeared to be but a few inches to overcome when the shaft would find its absolute perpendicularity and settle on its new base—when the hoisting sud-denly stopped! It was seen that the ropes were yielding! Fontana had nes-iscied to allow for their tension. A feel-ing of personal dismay yan through the strained to a tragel tensently, but sud-denly, in that deathly, silent suspense, a voice rang out:

Prilm Sunday, so long as, his hamily should last. And to this day in the side town of San Remo, where the Breens people irred—on the Italian above of the beautiral Mediterranean Sea, on the calebrated "Riviera"—most of the patine used in Rome and many other places in the Catholic world are gathered.

A Wonderful Dinosaur Mummy

(Continued from page 505,) abdominal surfaces the epidermis was certainly drawn within the body cavity; abostinial surrace are opposed to correlating frava within the body correlating fravalle fravalle for the shrinkage of the tissues within At the termination of a low-water season, during which these processes of desiccation took place, the "munmy" may have been caught in a sudden flood, carried down the stream, and rapidly buried in a bed of fine river sand intermingial with aufficient elements of clay to take a perfect cast or mode of the epidermal tissues had time to soften under the solvent action of the water. In this way the markings were indicated with absolute distinctness. The outer covering or skin of the trachodons was of a thin character and made up, scoonding to skin of the trachodoms was or a thin character and made up, according to Prof. Osborn, of large and small size tubercles which varied in size and ar-rangement in different species. Associ-ated with this varied epidermal pattern there was probably a many-colored sur-face design. The theory of a color pat-tern is based chiefy upon the fact that the larger tubercles concentrate and become more numerous on all those portions of the body exposed to the sun,
that is, on the outer surfaces of the fore
and hind limbs, and appear to increase
also along the sides of the body and to
be more concentrated on the back. On
the less exposed areas, the under side of
the body and the limbs, and the limbs, and the limbs are the limbs. the larger tubercles concentrate and be the body and the inner sides of the limbs, the smaller tubercles are more numerous, the larger tubercles being reduced to small, irregularly arranged patches. From analogy with existing litards and snakes it is supposed, therefore, that the trachedons presented a darker appearance when seen from the back and a lighter appearance when seen from the front. The jaws of the large head were front. The jaws of the large head were provided with a marvelous grinding ap-paratus composed of more than two thousand separate teeth, the most highly specialized known. The long, powerful, specialized known. The long, powerful, and compressed tail was used principally as an organ for swimming, acting as a propeller, and also served to balance the e and propeller, and also served to balance the difficultion body when the animal assumed a stand-indeed in posture. The trachodous had no so proteing armament, and when pursued some a constant of the difficulties are designed as a constant of the difficulties

Deviation of Bore Holes

(Continued from page 500.)
triangle whose base is the diameter of the ridges and whose vertical angle is the angle of deviation. But while the acid solution will enable the amount of lacted to allow for their tension. A feeting of personal dismay ran through the mind of every one. The situation was strained to a tragic insensity, but suddenly, in that deathly, slient suspense, as voice rang out:

"Acqua alle funit"

It was a desperate ory from one of the multitude to throw notes and the workers of the multitude to throw worker on the roper. As quick as a final the workers of the multitude to throw worker on the roper As quick as a final the workers of the multitude to throw worker on the roper. As quick as a final the workers of the multitude to throw worker on the roper. As quick as a final the workers of the multitude to throw workers on the roper as passe. The man that shouted the mad no fear of the penalty—gave not touch we will be the state of the penalty—gave not touch we will be the state of the penalty—gave not touch we will be the state of the penalty—gave not touch we will be the penalty—gave not touch we will be the penalty way out of an impending catastrophe. Without an instant's delay bucket after bucket was carried from a nearby fountain and dashed upon the cordage. As the strands shrank under the inspired bantism they drew the obelisk into piace. The combined data would enable a very fountain and dashed upon the cordage. As the strands shrank under the inspired bantism they drew the obelisk into piace. The combined data would enable a very fountain and dashed upon the cordage. As the strands shrank under the inspired bantism they drew the obelisk into piace. The combined data would enable a very fountain and dashed upon the cordage. As the strands shrank under the inspired bantism they drew the obelisk into piace. The bear of the course of the penalty—gave and the penalty—gave and the penalty—gave and the penalty—gave and the penalty of the penalty—gave and the penalty would frainth a meals of determining the p



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netic needle. The upper and detachable bulb also contains liquid gelatine. Here, however, a very sensitive plumb rod of glass is immersed. The conditions of specific gravity are such that the rod assumes the vertical, however the tube as a whole is situated. This arrange-ment is lowered to the desired point and the calatine allowed to one) and fit the ment is lowered to the desired point and the gelatine allowed to cool and fix the plastion of magnetic needle and plumb red relatively to the tube When the apparatus is brought back to the surface in its container, the problem is to replace the tube in its position at the time of solidification. This could be done by simultaneously bringing the needle to bear north and the plumb to hang vertical. In effect this is done by means of an instrument ceiled a climometer. This is shown in the figure with the climostat (as the gelatine tube is termed) placed in position upon it. At the upper part of the instrument zer two micro part of the instrument are two micro part of the instrument are two micro placed in position upon it. At the upper part of the instrument are two micro-scopes. These are so arranged as to have their axes continually in a horizontal plane. The hulb of the clinostat con-taining the plumb line is placed at the intersection of the lines of vision. By the aid of vertical lines ruled on the obthe aid of vertical lines ruled on the object glasses the carrier of the clinostat may be variously inclined until the plumb becomes vertical. It remains now to maintain this inclination, whose amount may be read on the graduated vertical arc, but to adjust the tube until the needle is brought to a north position, or to effect an equivalent adjustment. The latter course is the one sectually pursued A horizontal mirror is rotatably arranged below the lower bulb. tually pursued A horizontal mirror is rotatably arranged below the lower bulb. By adjusting this mirror until the nee-dle gives an image parallel to a series of parallel lines ruled on the surface, the amount of horizontal deflection of the needle from the meridian may be de-termined. A horizontal circular scale

termined. A horizontal circular scale facilitates this matter.

The inventor of this instrument is E. F. Macgeorge.

The first application was in con-The first application was in connec-tion with a bore hole in Australia Upon the assumption that the hole was ver-tical, it was found impossible to find it by an exploratory level. By the aid of this device, it was, however, found at a depth of 30° feet At this point the deviation from the vertical had amounted deviation from the vertical had amounted to 10 per cent of the depth. In fact, the next 130 feet increased the deviation to a total of 75 feet—15 per cent. The search cost altogether about \$18,000 It is said that if the device had been available at the beginning, the cost of driving the level would have been only about

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An Aerial Post in India ader Graham Bell has ju As Ascial Post in India.—Dr. Alexander Graham Bell has just returned from a trip around the world, which he made in exactly one year. In India he witnessed the trial of an aerial post, two mall bags containing 3,000 letters being carried across country by seroplane to a central mailing point. He mailed a letter by this aerial mail routs to his nine-year-old grandsom, Melville Bell Grosvenor of Washington, D. C. Callane, And. Call. Mr. A. C. Callane.

Bell Grovenor of Washington, D. C.
College Acro Club Meska—The Yale
Acro Club Is holding a two-day aviation
ment at New Haven, Conn., beginning
May 18th. Glenn Curtiss, McGurdy, and
Lancoln Beach are the chief aviators.
The Harvard Acro Club expects to hold a
glider meet at the aviation field at
Squantum (near Boston), from the 37th
to the 30th inst. There is considerable
interest among the acro clubs of the various colleges, and all are trying to bleed
in the near future.

in the near future.

The Death of Lieut. Kelly.—Early in the morning of May 10th Lieut. Kelly had been flying at San Antonio the recently-purchased Curtiss military biplane with success. He was obliged to alight upon a rather small spot, and in doing so descended at a sharp angle. He stopped the motor before striking the ground, but the force of the impactment and shot aloft, only to creath to the earth with terrific force. The lestenant was thrown out and had his skull badly fractured, the wreck of the biplane falling upon him. He died in a few minutes.

Agronauties in Japan.—According to

Aeronauties in Japan,—According to out a fiying field at Tukurosawa. This year a large hangar is to be erected, in which Baron Yamada's dirigible will be housed. Further sums are to be used in adding Japanese constructors of aircraft, and in building a factory for military flying machines near Tokyo.

Two Freach Officers Killed.—On April 14th Naval Lieut. Byasson, one of the best and most pruden; of the French officers interested in aviation, fell to his death hear Rambouillet. Four days later.

cers interested in aviation, fell to his death hear Ramboullet. Four days later Capt Tarron also was killed. His machine dived to the ground, where it landed bottom side up, completely demolished The aviator was found over 200 feet away. He had been instantly killed by the fall, Both these secidents occurred with Maurice Farman biplanes. It feet awy. He had been instantly killed by the fall. Both these accides to be the fall both the fall. Both these accides to be the fall the second of the

are only a few of the more serious and deuts which occur from lack of predence and judgment.

Parior Cer for Election Endward and two-car train is soon to be used on the Illinois Traction System, which will consist of a meter car with library said but fet, and a trailer of parier byge with observation platform. This will make travel on the electric railway as comfortable as that on steam trains, with the further advantage that the passengers will not be bothered with cinders and mobbs.

An Enormous Battery.—A huge storage battery is being built for the light and power company of Baltimore. The entire weight of the battery will be 540 entire weight of the battery will be 540 tons, and it will be able to turnish 3,000 kilowatts per hour when fully charged. The battery will consist of 156 cells, each 150 inches high, 31.75 inches wide, and 6 feet long. Without the plates and the electrolyte the weight of each cell will constant 138 plates.

Gasoline-Electric Car.—A gazoline-electric car was recently built for the Buffalo, Rochester & Pittsburg Rafiroad. This car proceeded under its own power from the shops at Schenectady, N. Y., to its desti-nation, over the lines of the New York Central Railroad, making the trip of 325 miles without delay or trouble of any kind, and this furnished an excellen-proof of its adaptability for general ser vice. The power plant consists of a gase-line engine directly connected to an elec-tric generator, which furnishes current for standard motors mounted upon the axies. It carries a storage tank for 100 gallons of gasoline, on which it can travel 200 miles.

Aeronautics in Japan.—According to good miles. Cattachrift for Luttacht, the Japanese government spent [141,130] real and year in connection with aeronautics. (A yen is apportunitely apparatus for the purification of its severable where sent abroad to study seronautical methods and purchase aircraft.

A large amount was also spent in laying out a flying field at Tukuroawa. This year a large hangar is to be exceted, in which Baron Yamadas' dirightible will be housed. Further sums are to be used in adding Japanese constructors of aircraft, and in building a factory for military distinctions are Tolyto. bacteria. The cost of operating the plant at 4 cents per kilowatt hour is \$2.16 per day.

Removing Lead Sulphate from Lead Plates.—A recent number of the Elec-trical Review and Western Electrician contains directions for removing lead sulphate from the lead plates in storage supplace from the lead plates in subrage batteries. A set of plates had become coated with lead hydroxide, and had then been transferred to a bath of dilute sulbeen transferred to a bath of dilute sul-phuric acid, where a coat of lead sulphate was soon formed. The acid was washed off in water, and then the plates were soaked in a solution of three parts water, one part ammonium bardexide, and one part ammonium acetate, by weight When the plates were clean they were washed in plates were clean they were washed attended to the plate of the plate of the sulphuric acid of specific gravity 1.1, and after remaining in the acid for an hour they were taken out and dried.

working below \$4. wolt. The places are below and covered with a layer of yallow coide. To reduce this the plates are charged at one ampere yer cubic decimeter in 1.15 specific gravity sutphrite acid, then glace are ownered for twelve heurs. This gives negative plates. When politive plates are ownered, these latter are charged as achieved in 1.00 supplies to the country of the co







loitte Gasoline Table Lamn A bacutital lamp for house, having offers, convenient. Pertonies, miles can be terred against a relicio on the force without factor or difficulties the first without dispute or difficulties the Co. F. of out, builtings injust, considered comb parts to the contract against the parts and opposes. ACCENTS—We considered, considered, and to the contract against the parts of the contract and the contract against the contract and the

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MONOPLANES and BIPLANES

THEIR DESIGN, CONSTRUCTION and OPERATION

The Application of Aerodynami Theory, with a Complete Desaription and Comparison of the Notable Types

Burlleweer Cleveland Looming, B. Sc., A. M.



Ariston is a predomina, topic in the mind of the public, and in singlely becoming one of the greatest goals of developing one of the greatest goals of development of the progressive engineering and estentific world. In the many books that have already been written on a visiton, this fastenating subject has been handled angaly, either in a very "propular and angaly, either in a very "propular and any puzzies beginners, and is often of little values to ariston themselves."

There is, consequently, a wide densates for a practical book on the subject—book treating of the theory only in it fence relation to actual survoyate design and completely setting forth and discussive preveiling practices in the construction and operation of three machines. "Monoplanes and Biplanes" is a new anasthorisative work that deals with the subject in precisely this manner, and invaluable to snyone interested in avia-tion.

Mr. Loening, who has come in internacenter with any of the most receivations and constructors and who has made a profound study of the subject for year, is unusually well informed, and is workly recognized as an expert in this line. In a clear and definite style, and in a rematihe the subject of a state of the will have been supported by the contraction of the subject of a state of the character of the insumerable illustration. The selectific exactness of the valuable data and reference, as well as the high character of the insumerable illustrations and diagrams, remain this work easily the complication of the contraction of the contraction of the conplication of the conline of the contraction of the contrac

Following is a table of the contents:

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PART II.

Detailed Descriptions of the Notable Asseptance.

Chapter IX. Institution II. President I. President II. President I. President II. President II. President II. President II. President II. President III. President III. President II. President III. President IIII. President III. President III. President III. President III. President III. President III

PART III.
Comparison of Types.
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him (6:814 inche) 340 Pape, 278 Beste Steen Attendisely bound in cloth. Pitton \$2.50 inct, postpaid då Budschif, descriptor propier

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Science

The Lihyan Desert to Be Explored in an Airship.—It is stated in Petermanus Mitteilungen that Dr. L. Seigert, the geologist, will shortly undertake to cross the Libyan desert in an airship. He expects, with the aid of the prevailing winds, to make the journey from the Mediterranean to the Nile in about thirty hours, passing over a region that is at present almost entirely unknown to swormhare.

The Cruise of the "Carnegie."—The magnetic survey yacht "Carnegie," belonging to the Carnegie Institution, is reported to have reached Cape Town on traveled about 1,400 miles in the Atlantic Ocean. Dr. Bauer, director of the Carnegie Department of Terrestrial Masnetism, who went to Samoa to carry on magnetic boservations during the solar cellipse of April 28th, expects to join the ship at Colombo Ceylon.

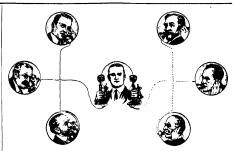
Exploration of the Benue.—It has taken sixty years to completely explore the great Benue River, the principal tributary of the Niger. According to the Bulletin of the American Geographical Society, the last unknown stretch of theriver has been surveyed by Capt. Strümpel, in charge of German interests at Adamaus, Kamerun. Flegel discovered the headwaters of the Benue north of Ngaundere in 1882, and in 1839 Passarge extended the survey up the river from Gerua to Bubandjika Strümpel has surveyed the stream between its headwaters and Passarge's farthest.

The New Director of the American Museum of Natural Hastory.—Dr. F. A. Lucas, who has been curator in chief of the Brooklyn Institute of Arts and Sciences since 1904, has been appointed director of the American Nuesum of Natural History Dr. Lucas has rendered important services for the government in the fur seal controversy of the Boring Sea and in preparing exhibits for the National Museum at Washington He is a thoroughly experienced, well-trained man, in every way qualified for chigh position he is descined to fill.

The Yale Expedition to Peru.—Under the direction of Prof. Hiram Binsham, a party will leave Yale University on June 10th to carry on geographical, archeological and historical exploration in Peru A cross section of the Andews will be made through a country that has never been scientifically explored and only mapped in the rudest possible way. The party, which will probably consist of a physiographer and geologist, a skilled topographer, and possibly a surgreen and naturalist, besides the director, expects to spend five months in the field

five months in the field Geologic Work of Anta.—Prof J. C. Branner, in the Builtin of the Geological Society of America, Generibes the immense importance of anis as geologic agents, especially in tropical regions. Ant burrows have been found at a depth of 5.5 meters, and they ramity over wast areas. The geologic work performed by earthworms has long been recognized, but Prof. Branner believes that the anis and termites of the tropics bring a greater amount of earth to the surface than do the earthworms of the temperate sones, and are in many ways an equally important factor in the changes that are going on in the upper strata of the ground.

Destruction of a Well-known Meteorological Station.—Petermanns Miletians per reports the descriptions of the Meteorological Station, at Vassifaure, in Swedish Lapland. This station, tying swell within the Articl Circle (att, 66 deg. 26 min.), was founded in July, 1906, with the aid of funds contributed by a number of scientific men, and its observations have been published in detail by the Royal Swedish Academy of Sciences Many members of the last International Mesological Control of the Control of Science, will regret to have of the catastrophe that has overtaken it. There is a prospect that, in stead of rebuilding the station at Vassifiant, a new station will be erected at the tourist resort Ablako, on the Torbe Table.



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TWO telephone systems in one town mean a divided community or a forced duplication of apparatus and expense.

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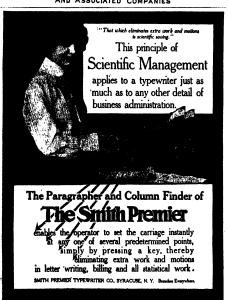
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The Railroads of a Continent

THE JUNE MAGAZINE NUMBER OF THE SCIENTIFIC AMERICAN ISSUE OF JUNE 17th, 1911

Transportation facilities and civilization go side by side—a people's means for getting about give a pretty good line on their development in other regards. For this reason, among others, we are devoting the greater part of the June mid-month number of the Scientific American to the story of that marvelous network of railroads, which, during the past three-quarters of a century, has been woven over the face of the United States and Canada.

We have all heard of the Interstate Commerce Commission; but how many of us know what it is, what it has done, and what it aims to do? These questions will be answered in an article by the able Chairman of the Interstate Commerce Commission, Judge Judson C. Clements. He will tell you what the Commission has done to make travel safe by the use of automatic couplers, the air brake and the block signal system, and how the Commission regulates rates and otherwise safeguards and harmonizes the interests, both of the public and the railroads.

In bygone years, there was much cause for the hostility of the public to the public carriers; but conditions have now changed for the better. To-day there is no reason why the public and the railroads should not settle down into an attitude of friendly cooperation. This, at least, is the conviction of the Scientific American; and it is shared by Mr. W. C. Brown, President of the New York Central and Hudson River Railroad, who will contribute a characteristically clear and forceful article on this subject.

One-half of the railroads of the world are to be found in the United States, and, as usual, we have



stamped our individuality strongly upon them. The most picturesque and remaintic element in our system is the half dozen great transcontinental routes, which span that wonderful stretch of plain and mountain that her between the Mississippi River and the Pacific. The story of the transcontinental roads will be told by Mr. William E. Hooper, Associate Editor of the Railway Age Gasette. Not many people know on what a vast scale the railroads of Canada are reach-

ing out into the undeveloped lands of our great neighbor to the north. This story in itself will form a shapter of shalling interest.

It is a far cry from the little locomotive De Witt Clinton, of 1831, weighing six tons to the mammoth freight locomotive just completed by the Atchison road, which is 122 feet long and weighs 425 tons. The story of the growth of the American locomotive will be told by an expert historian, Mr. Herbert T. Walker. In the eighty years covered by this period, a search for the ideal locomotive brought out some curious freaks, among which was one with 10-foot driving wheels. The same author will write entertainingly on this subject, and a score of excellent drawings, made from early original manuscripts, will earich the text.

The American sathoad has always grown faster than its terminals; but we are to play atoning for the neglect by building the most magnificent terminal stations in the world. The largest of these, the new Gannel Central station in New York City, will be described and richly illustrated. The text will tell how the millions of the future will be deally received and distributed by methods that are entirely new in the millions world.

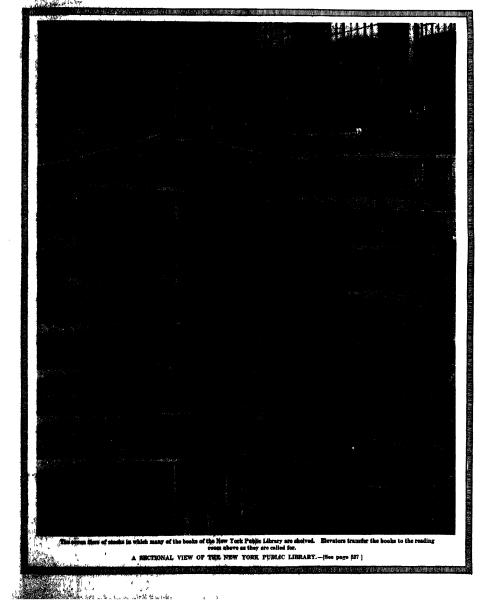
Let it be understood that the above articles will be matter additional to the regular paper, which will contain the usual editorial, aviation, science abstracts, investors and other would department.

CENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

271

NEW YORK, MAY 27, 1911



SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, MAY 27, 1911

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The Editor is always glad to receive for examination illustrated articles on subsects of timely interest. If the photographs are share, the articles shart, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space ratio.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Niagara Falls Again Threatened

NY one who, after an absence of a few A may have recently visited Niagara and con-scarcely fail to have noticed certain startling changes in the appearance of the great waterfall. Stretches of rock which once were covered now lie bare, and on the Canadian shore there are several hundred feet of reclaimed ground over which, before the opening of the Canadian power stations, there flowed a shallow but highly picturesque reach of tumbling water. In 1909, the chief of engineers of the United States army, in reporting upon the question of the depletion and defacement of the falls, said: "The falls have unquestionably been seriously injured by the diversion already made, and additional diversion now under way will add to the damage." Already the Bridal Veil is considerably lessened in volume, and west of Terrapin Rock, hundreds of fect on the brink of the American part of Horseshoe Fall are barely covered. Should further water be diverted from above the falls for power purposes, this stretch of shallow water will disappear, and the crest of the waterfall will be reduced to that extent.

These changes in the appearance of the falls are due to the fact that out of a total average flow of 222,400 cubic feet per second of Niagara River, \$4,000 cubic feet per second has been diverted from the upper river, and is now flowing through the turbines and tunnels of the power companies instead of passing over the falls.

At the present time, a determined effort is being At the present time, a determined capt is some made by these companies to secure permission to divert immediately 22,000 cubic feet per second in addition to that which they are now using, making a total of 56,000 cubic feet per second, or 25 per cent of the average flow of Niagara, and 30 per cent of the average now of Niagara, and 30 per cent of its ordinary low water flow. If the power companies are permitted to do this, the crest line of Niagara Falls, particularly on the shallower American said, will be so greatly reduced as to rob the stupendous spectacle of a great part of its dignity and beauty.

nator Burton has presented a bill to Congress, which is designed to prevent any further diversion of water. The first Burton bill, passed by Congress in 1906, and extended in 1909, gave to the power companies all the water that they were at that time making preparations to use. The Waterways Treaty with Canada established a maximum limit of diverwith Canada established a maximum limit of diversion from the river above the falls, of 36,000 cubic free per second, purely for power purposes. Now the Burton bill expires June 29th, 1941, and acting upon the opportunity presented, the power companies claim that they must at once be allowed to use the full maximum limitation of 36,000 cubic feet per second, as determined by the treaty. Senator Burton's joint resolution continues the provisions of the Burton bill during the life of the

Canadian treaty. Should the bill be passed it will preserve the falls as they are, without stopping a single turbine in the present huge power house, or hindering the operations of those vast electric-charical and other industries which have sprung up at

iagara and in its near vicinity.

The power companies are seeking permission to use 68 per cent more water than at present. This additional development would yield to them ultiadditional development would yield to them that mately an income of several millions of dollars per year. But it would do so at the cost of greatly damaging a supendous natural spectacle, which is distinguished from other natural phenomena of the kind by the fact that it lies at the very doors of the millions of people with whom it is so descreedly popular.

There can be no doubt whatever that it is the wish of the people of the United States that Niagara Falls be forever left intact.

Automobile and Aeroplane Records

T is a distinct tribute to the internal combustion motor that among vehicles the records for high speed should be held by the automobile, and that The aeroplane should be surpassing its own records at a rate which makes it possible that the speed record will ultimately pass from the earth into the air and be claimed by the racing aeroplane of the

With all due deference to the steam and the electric automobile, in each of which highly meritorious pioneer work was done, it will not be disputed that it was the advent of the gasoline engine which made the present perfected automobile possible; and when once the present essential standards of construction once the present essential standards of construction had been reached, it was merely a question of time and inclination as to when the present phenomenal racing speeds would be realized. At the opening of the present century, the highest authentic vehicle speed record was that of the railroad train, and it stood at about 90 miles per hour. We are aware that speeds of 100 miles an hour, and over, have been claimed; but investigation shows that the conbeen claimed; but investigation shows that the conditions of timing were not sufficiently accurate to guarantee acceptance. It is generally agreed among railway men that the highest railway speed lies between 90 and 100 miles per hour, with the probability of the lower limit being nearer the truth.

It should be understood that we are speaking of speed on steam railroads. On the electric railroad,

the record stands far higher; for several years ago, in the celebrated German experiments with powerfully-motored electric cars, a limit of slightly over 131 miles per hour was reached on a stretch of straight and level track. In this case, the car

straight and level track. In this case, the car was furnished with motors of over 9,000 horse-power. In March of last year one of the powerful Bens racing cars, run by Oldfield, and equipped with engines of 200 horse-power, made a series of trials against tune on that famous speedway of smooth and in Florida, Ormond Beach, in which the mile was covered in 27.88 seconds, at a speed of 181.7 miles per hour; the kilometer in 17.04 seconds, cquivalent to 181.8 miles per hour; and two miles in 55.87 seconds, at a speed of 128.6 miles per hour. These wonderful performances put the automobile on a par with the powerful German electric car, on a par with the powering or running on a regular railway track. Last month, however, the same Bens car, driven by Burman, covered the mile in 25.40 seconds, at a speed of 141.8 miles per hour; the kilometer in 15.88 seconds, at a speed of 140.9 miles per hour; and two miles in 51.28 seconds, which was equivalent to a speed of 140.4 miles per hour. Thus the automobile stands to-day as the fastest vehicle that man's ingenuity and skill have been able to produce.

Compared with the automobile, the aeroplane is the interest in its cath, if not in its infance.

yet in its youth, if not in its infancy. Nevertheless, in its construction, motive power and certainty of control, it is destined to undergo a development which will be even more rapid than that of the automobile. In this matter of speed, it is advancing automonic. In this matter or speed, it is advancing even more rapidly than did its brother of the road and the racing track. Although the year is not yet six months old, records have been broken in rapid succession, and there is promise of even more remarkable performance before the year shall have closed. Thus, early in the year, Nieuport, driving closed. Thus, early in the year, Nieuport, driving a Nieuport monoplane of moderate power, covered the 100 kilometers in 59 minutes and 16 seconds, which is equivalent to a speed of 68.91 miles per hour. Later, on April 18th, LeBlane, in a 100 horse-power Gnome-driven Blertot, covered the same distance in 54 minutes, 38 5/5 seconds, which is equivalent to a speed of 67.88 miles per hour. Finally, Nieuport, in one of his Nieuport monoplanes, equipped with a Gnome motor of high

power, flying over a classed 100-billouseur, wheest, retails the distance in 50 infrances and a seconds, which is equivalent to a speed of 78-85 miles per leasn.

As to the future, it is probable thus from 10 to 15 miles per hour will be added to the record before the close of the year. Blettet is known to have built a reading monoplane which will be equipped with a Gnome motor of 140 horse-power; and since these machines will have the new facilite planes, there will be a rise in speed, due not merely to the greater power, but to the lessened resistance of the machine itself.

The success of Nieuport is significant; for he has evidently paid much attention to the reduction of licad resistance and the elimination of skin friction these being questions the importance of which has been too much neglected by the designers and builders of racing machines.

Pure and Applied Science

MUCH has been said and written on the value of pure science, and the inter-relation the value of pure science, and the inter-relation applied science. There are enthusiasts, to whom practical application savors of desecration; somewhat more numerous are those extremists who see in "practical" results the only extremate who see in practical, results the objective of the pursuit of pure science. It is true that these men usually lack the philosophical faculty which would force them to make their own position clear to themselves by examining the concepts lying at its foundation. What, after all, is practical? Is it not, in the last analysis, that which is the concepts of the property of

practical? Is it not, in the last analysis, that which brings pleasure or alleviates pain? To a certain type of mind, art brings pleasure, and pure science the most intense satisfaction. Un-less such pleasures are bought at an undue cost to the community, art and pure science, then, carry their own justification. Added to this is the fact their own justification. Added to this is the fact that they furnish the highest and most refined type of recreation to the appreciative, though not perhaps actively productive class, suffusing, like some unperceived but powerful undercurrent, higher ideals among their devotees. It would scenn, therefore, that the advocates of pure science for science is ake have a strong case to plead, while the ground on which the "practical" extremist stands hardly passes the muster of close logical analysis.

Probably the majority of broad-minded, thinking men wisely take a median position. They, perhaps, do not side quite with the enthusiant for pure science, neither do they approve of an attitude of discouragement toward all acientifie work for which they foresce no immediate practical application. They point out how the seemingly most abstrues electrific investigations have again and again grown to unexpected and most important useful application. On the other hand, it has been urged that the pure scientist is apt to be a prophet after the event, who merely analyses the scientific principles on which depends the working of the device constructed with intuitive wisdom by the practical man. It cannot be denied that instances are plentiful in which practice has thus outstripped scientific theory: but this only above that they furnish the highest and most refined type

in which practice has thus outstripped scientific theory; but this only show relation between theory; but this only show relation between pure and applied science is of a mutual character—each stimulates and fertilizes the other. Nor is such analysis of an accomplished fact a fruitless such analysis of an accomplished fact a fruitless addition to our knowledge. Perhaps the most remarkable illustration of this is the second law of thermodynamics, the recognition of which may be said to have been the immediate outcome of Carnot's best outside the control of the reflections on heat engines. The knowledge of this law has not only placed in the hands of the engineer a sure guide for his technical work, but has proved a seemingly inexhaustible source of scientific conclusions of the utmost importance, throwing light clusions of the utmost importance, throwing light on such varied phenomens as physical change of state, chemical dynamics, electro-chemistry, luminous, walistion and so forth. We may well pause before we adjudge a greater importance to the purely technical considerations which originally rempted the classical "Reflections on the Motive Power of Heat," than to the deductions which pure science has drawn from the principles laid bare by Carnot, Classias and Lord Kelvin. And there are many indications that the full score of there are many indications that the full scope of the second law, in some of its forms, is not yet clearly exposed. The attempts which have been clearly exposed. The attempts which have been made here and there to apply a principle of "in-crease of entropy" to phenomena of biology, sociology, conomics and the like, may as yet be crude and lacking in that rigor which is demanded for a well-established scientific system, but they have been numerous and have one from the confinent well-established scientific system, out they have seen too numerous and have ecome from too ensheat sources to fall to arouse our interest and awaken our hope for an ultimate clearing up of these frandamental questions also in the light of the great lev-

"Ehrlich-Hata 606"

How It was Discovered

IN order to trace the complete history of the discovery of "Ehrlich-Hata 604." now known as garvareas, we must go back nearly thirty wars, to the time when the control that an illustration of the exhibit the method of the control that the control that they are in regard to extile fibers. The saw method of differentiating and studying the various elements of the body by mean of dyes was enthusielement to the body by mean of dyes was enthusiationally taken up by Weigert's friend and counts, a preference illustration of the scademic enperiors and laboratory assistants. "The traces of Ehrlich's diligence are inefficientless."

In an article in Dio Umachou, an abstract of which is here presented, Prof. Bachhold expresses the opinion that it is still too soon to estimate the full importance of these early experiments of the young hybridegist, which exhibit remarkable inventive ingenuity and perfect scientific technique, and suggest numerous theoretical problems that will not be

solved in a generation. For our present purpose we need consider only two fasts established by these experiments—the effect of dyes on the blood, and the organism's need of exrgen. The blood consists of a cooless liquid, in which floor various ceils, of which the red and the white corpuscies are the most numerous. The red corpuscies are all allke, but the white corpuscies are all allke, but the white corpuscies are all allke, but the white corpuscies, or letteney the second of many varieties. Ehrlich found that acid, haste and neutral dyes were required, in different cases, to stain certain peculiar granules which are imbedded in the white corpuscies. From these investigations Ehrlich conceined that many elements of animal tissue possess specific affinities for particular dyes, and he was led to inter that they obsions.

There are many non-poisonous dyes, of which methylene bine is prosqiarly suitable for experimentation of mothylene bine is injected under the skin of a white mouse, all parts of the skin soon become deep bine. The color is most conspicuous in the tail, feet, syelids and other hairless parts, but it shimmers everywhere through the thin white fur and appears in the urine, showing that the dye has traversed the entire circulation if the mouse is killed, and thin sertions of various organs are examined with the microscopa, it is found that the color is not uniformly diffused, but is accumulated chiefly in certain cells and tissues, especially tucheful reactions also come into play. Those cells which respecially require oxygen supply their needs from the dyeaturf, which is thus converted into a coloriese compound. These cells, therefore, appear unstained, but they may turn blue on being exposed to the air. This research

turn blue on heing exposed to the air. This research fed Ebriko to the discovery of the principle of disiribution, according to which the effect of any circulocatura or poison depends on the way in which it is distributed through the organism. For example, specific nerve poisons owe their deadly character and their potency in very small closes to their property of

necumulating in the nerve cells.

These results suggreated the possibility of destroying the germs of disease (bacilli and protocos) within the body by the lifeministration of poisons having so great specific affinity for the germs that nearly all of the poison accumulates in the germs, and only a very small portion is left to affect the cells of the diseased human or animal organism. Ehrlich even contemplated the possibility of discovering substances entirely ignoceous to human and saimal life, but activity ignoceous to human and saimal life.

ing as specific poisons toward disease gwrms. Shrinkin driver to realize this Idae were commenced about ten years ago. His first soarch was for a disease garra and an animal subject with which decisive experiments could be made without difficulty. He forest the garris in Trypaneaeman, a protosoun, or thicellities animal organism, characterized by a pearshaped bedry and a long fortile tail. It is a little signaline than the human red blood corpusels, and its presents in a drop of blood, examined with the microsofts, it formed that the human red blood corpusels and the protocol of the state of the whighlite stall, the stall the state of the whighlite stall the stall the

CENTRAL PROPERTY.

eases, including the African horse and cattle plague or nagana, the caderas disease of horses in South America, the Indian the plague, or surra, the human "sleeping sickness." and others.

human "sleeping sickness," and others.

White mice were found to be scellent subjects for experiment, and susceptible to both surra and magars if a little blood containing trypanosomata is inject into the circulation of a mouse, the parasites will be found in a drop of blood drawn from the animal's tail on the second day after the incoulation, before any external symptoms of illness have appeared on the third day the protosoa are very numerous, and death susually occurs on the third or fourth day.

In the hope of finding a remedy for the disease,

In the hope of finding a remedy for the disease, Ehrlich incoultated thousands of mice with a great variety of substances. He showed a strong predifiction for dyes, through which, he often asserted, lies the way to the discovery of new remedies. He exbilited an astonishing fertility in the production of new dyes, which is the more remarkable as he is a physician by profession and entirely self-taught in

PROF. EHRLICH AND HIS ASSISTANT, DR. HATA

chemistry. By methods peculiar to himself he produces and studies new dyes without using balances, graduates or nay apparatus except beakers and test tubes His laboratory contains thousands of glasses filled with chemicals and scattered in apparently hopeless confusion. Once a pupil arranged the glasses systematically, and Ehrlich was unable to continue his work until the normal state of disorder had been restored. The floor, tables and chairs are statined with dyes, and the walls and doors are covered with chemical formulas and notes.

chemical formules and notes.

For a long time Ehrlich was compelled to have his numerous chemical ideas worked out by friendly chemists and manufacturing firms, as his position as director of the Royal Institute of Experimental Therapeutics gave him neither room nor means for extensive chemical researches. Subsequently the foundation established by Frau Spayer gave him an independent laboratory and a body of assistants and pupils with whose aid his ideas could be developed

Ehrlich obtained good results from several of the dyse employed is these experiments. A dye which he called trypan are proved especially poisonous to the trypaneosmata, but only slightly poisonous to the lifected mice. A single injection of the dys sufficed to awe the life of a mouse which was at the point of death Two other dyse, parathenaine and trypan rowe, exhibited similar properties. Hence Ehrlich had ontained the object of his search—a specific antidote which removes specific infection without injury, owing to its favorable "distribution."

In the course of these experiments Ebribed disin the course of these experiments the converted another biological law which determines the
conditions of success in combating infection by chemical means. In some cases the cure effected by injeccal means in some cases the cure effected by injection of tryman rose, etc., was permanent, but in others to
the trymantion of tryman rose, late of some or late, showing that not all of them had been killed. A second iningletion of tryman rose failed to remove the remaining
spiction of tryman rose failed to remove the remaining
infection. Moreover, when mire insculated with trypanesoma are treated with a series of small doses to form
the saftle of the contract of the place, and, what and that of the preceding. The trypan
oscionata acquire a tolerance for the polson, and, what and
command acquire a tolerance for the polson, and, what acquired
character to their property. This discovery lends to the
important conclusion that every trypanesoma in into
the body of the infected animal must be killed at a
tenting of the triper of the contract of the con

this power to its descendants, and if the injections are multiplied and progressively increased a moment arrives when the accumulated poison becomes more deadly to the mouse than to the trypanosomat. These dyes, furthermore, proved less effective in rabbits and horses than in mice, and gave little promise of furnishing a sure cure for trypanosoma diseases. Meanwhile Thomas and Herlin had em-

Meanwhile Thomas and Breini had employed areacophorylkyrin, a webleknown or ganic compound of arsente, with considerable success in the treatment of these diseases, especially the alcening atchness. Robert Kech applied this compound, under the new name alony, still more successfully to the treatment of alceping sickness in Africa. These results led Entrich to combine arsenic with the substances which he had found effective. In this way he obtained brilliant success in experiments with animals. The treatment of human subjects presents great difficulties which have not yet been cultiply overcome.

yet been cultrely overcome. Ehrlich next began, with the aid of the Japannees biologist Itata, to extend his Investigations to other disease govins, nearly related to trypanosoms. One of these is the protosom Spirochata politida with Schandlina, a few years ago, identified as the germ of synhilis Neither atoxyl nor the combination of stoxyl with mervure, proposed by Uhlenbuth and Salmon, proved smificiously poisonous to Spirochata, but Ehrlich was indofatigable in creating and testing new organic compounds of areasted at last he found in dioxydiamidoarseno-benzo, the six hundred and sixth of his preparations, a remedy which surpassed all expectations and which proved as successful.

experiments and winer proven as accessive in the treatment of human subjects as in experiments with animals. In the first eight months of its employment, the new remedy has effected nearly 5,000 rapid and apparently complete cures. One hypodermic injection suffices, and repeated doses are inadmissible for the reasons given above

Artificial Leather

CONCIDENT with that rise in the price of meat of late years which falls so heavily on the dometic economy of the average household, we note a rise in the price of leather, which is even a severer burden on the workingman, since available substitutes for the latter product of the range are at once searcer and more needed. It is encouraging, therefore, to learn that the efforts of the inventor to produce such substitutes have of late been crowned with remarkable success

A prise of 5,000 france has just been awarded by an agricultural committee of Terni to a Boigian inventor, Louis Gevacet, of Reveren-lea-Audonarde, for an unusually superior artificial teather The process, patented in 1907, and perfected by successive steps, consists in the more or less intimate imprenation of stout cotton cloth with tannic abuninoid substances. Shose made of this are said to possess not only the resistance and elasticity of natural leather, but it durability of wear. Morrower, they are much cheaper, coating, including manufacture, only about 4 france, and being sold at about 6 france per pair.

The state of the s

American Ideas in British Battleships

The "Monarch"—a Modified "North Dakota"

W.E. publish by the courtesy of the Illustrated arch." the latest and most powerful of the British dreadnoughts. The picture will possess unusual interest for Americans, inasmuch as it shows how strongly the ideas of our naval constructors have im-

sed themselves upon British design. he original "Dreadnought" carried The original

guns in five turrets In order to of these turrets were placed the wings of the ship, one on each broadside—an arrangement which. at the sacrifice of two guns in the abled the ship to concentrate six the same number astern

The officers of our own navy, both line and staff, have be-lieved that future engagements most entirely broadside to brondside, and that the time during which they will be fighting in the end-on position will represent but a small total time naval battle.

so placed as to enable all of them to be fired on either broadslile, and that end-on fire, being of secondary importance, should be sacrificed, if necessary, to broad-

Now because of the presence on deck of such obstructions as masts, smokestacks, conning tower, and Cack houses, it is found that the only way to secure maximum broadside fire is to place all the turrets on the longitudinal axis of the ship. Furthermore, with a view to increasing end-on fire, our navy, after mak-ing tests at Indian Head proving ground, which showed that there would be no inconvenience from the blast of the guns, boldly arranged the forward and after pairs of turrets at different elevations, so that the guns of one turret could fire over the roof of the adjacent turret. This arrangement gave, in a of the adjacent turret ten-gun ship a broadside fire of ten guns and an end-on fire of four guns. Now the British and Con-

tinental designers have hitherto looked with disupon the American plan, considering that the ships were weak in end-on fire, and that the enormous blast of the upper pair of 12-inch guns must fere with the work of the gun detachment in the turret below them. Hence, for six years past, the foreign navies have been building battleships which, when the actual battle bewill have from twenty per Corty per cent of their big guns out of the game and, for the time being (which means

for practically the whole of the time needs.

Thus in the British navy the "Dreadnought" and
the six battleships of the "Bellerophon" and "Saint Vincent" classes, during a broadside be deprived of twenty per cent of their main arma-ment. In the German navy, matters are even worse, since the four dreadnoughts of the "Nassau" class

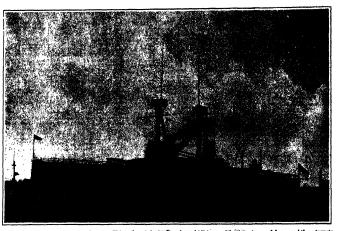
jectiles in a given time than the county when posing that the speed of fire per gan is the same. This is a handicap which can hever be over and at this late hour, foreign designates mean waking up to the seriousness of the sitheting. tically all of them have frankly adcan principle of superposed tures longitudinal center line of the ship. The latest to fall

British, and the picture of their first 13%-inch-gun battlembip, have adopted the American idea. disposition of the guns is identical with shown tion of the "New York' and "Texas." Forning tower are two turrets, the guns of the after turret firing the turret in front. Then follow the two amokestacks and a super-structure screens within the ship's boats. from the blast of

mediately aft of the after smokestack is a turret, and aft of the engine-room batch and super-structure are two turrets, arranged so that the forward guns may over the after turret.

It is probable that in its battery arrangement this system will remain permanent in future construction.

If the batteries are increased, it will probably be by the inclusion of more guns in each turret. If the dis-placement of the "Monarch" were increased to enable her to carry fourteen guns, the mounting of three guns in each of the two turrets forward and aft would erable her to fire six guns shead and astern and at the either broadside.



British "Vanguard" of ten 12-inch guns. This is the original "Dreadnought" type, with a turnet on each beam and three turnets on center line. In this arrangement the superstructure "masks" interferes with the off turnet during a broadside cargament.

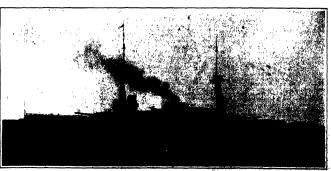
will be deprived of the service of thirty-three and a third per cent of their big guns in the French navy, the six battleships of the "Danton" class will lose nearly forty per cent, and the later ships twenty per cent, of their battery power. Japan is no better off; about forty per cent of the big guns of the "Satsuma" and "Aki" will be idle during broadside fighting, and er "Kawachi" and "Setsu" will be without the services of thirty-three and a third per cent of the heavy guns.

The above considerations show what a great advantage is held by our ships over vessels of equal gun power in the other navies of the world. The Japanese war showed clearly that the battles of the future will he fought broadelds to broadelds; and to the foresight and good judgment of the men who are respo ble for the design of our battleships we owe the fact that in a fight of our fleet against one carrying an equal number of guns, our gunners will be able to fire from twenty to forty per cent more heavy pro-

The Making of a Man

A MONG the many interesting "Foundations" in this country and abroad, that of Albert Kahn of

Paris is at least novel, and might for the making of has in past years foundations in England, and other countries, to benefit by similar act. A about \$2,500, is offered in this of traveling fellowship for s country who THE RESERVE OF THE PARTY SECTION AND ASSESSMENT



American system of gun positions in possess mayies

gelection of the fellow will be made by the trustosis, who are Bdward D. Adams, Nicholas Murray Buller, Charles W. Ellot, Etenry Fairfield Osborn, and Charles D. Walcott, and they are to choose preferably processors in loslated southern and western institutions. The reason for this limitation is that the men in the larger cities have ample opportunity because of their residences for coming into contact with the larger things of the world, and are much better

the larger things of the world, an equipped for advancement. It is known that in the smaller institutions of learning there are men of advanced thought, of great capabilities, and fine intellect, who have no opportunity to come into contact with the great world and are therefore wasted. They are occasionally head from in the world of art or letters, but never succeed in raing above their surroundings. It is to remedy this that the foundation has been established.

The trustees will select the fellow after careful investigation and will choose a man who is known among the educators of his neighborhood as having shown marked ability and promise in educ. 'on; who has shown ability to enter into the spirit of such a fellowship, and a likelihood of considering his work as a preparation for the performance of higher duties in the institution and education of the youth of his country, rather than a vacation of a year with sufficient money to enjoy himself. The object of the foundation is really to select a man who shall be sent over the world to obtain the broadening influence of traveling in, to him, unknown lands, and on his return give to his students the benefit of his travels

There are no restrictions upon him in this journey except that his titherary must be approved by the trustees and that his travel must be preferably in Europe. Egypt, India, China, Japan, Ceylon It is also preferred by the trustees that the incumbent of the follow-ship shall travel around the world, involving his absence from America for at least a year Atter his titnerary is approved by the trustees he may begth his journey, taking his own time to visit the countries, and at the conclusion of

his travels must submit a report giving results and impressions, which may be published. While it is likely that the man may be selected from some college or university, it is not necessarily the case.

The Restoration of Documents Charred by Fire By George A. James

One of the irreparable losses of the San Francisco fire was the ignorant destruction of charred and ecorrhed papers, recovered from safes, which, in all cases where records had not been reduced to ashes, could have been tensorabled on macronel.

could have been transcribed, or preserved.

My experience with over 20,000 documents of all kinds under treatment, without one failure in restoring the writing, assures me in stating that the writing.

of any document can be physically or chemically treated to develop the writing clearly enough for transcription, or preservation of the original

Most of the safes in the San Franclaco fire had been subjected to great heat and for a long period, which, of course, no non-conductor could exclude from their contents. Where the safes had not been broken o n bs falling masses. I saw none that had not fulfilled all that could reasonably be demanded of them, and the con-tents showed that air had been almost entirely excluded. The volstile portions had been distilled, leaving the original documents in the pe of carbon. A large proportion of vaults did not prove as good, and in most cases the contents of these were partly or entirely consumed In some cases the writing was plainly legible, but in the majority of papers re was no visible indication of

the original writing. It was to be presumed that chemical methods that would act on the iron residue left from most of the inks would be serviceable, but by experience it was found that these often gave the most trouble, and reactions with iron gave little or

I shall first describe methods for treating completely carbonized documents. My experience indicates that the only successful methods are more physical than



y corriso in the measure Lorent news.

The latest Erithis dreadnought "Monarch," carrying ten 13½-inch guns, has adopted the United States system of placing turrets, viz., two forward and two aft with guns superposed, and all turrets on the longitudinal center line.

chemical No method of writing or printing falls to produce some physical effect on the paper, and this be accentuated by carbonishing. Methods that will produce a physical reaction in the carbon to augment this contrast will render possible the residing of the record. Thus the writing or graphite pencils was found easible to read. This writing would super on the legible as such to read. This writing would appear on black paper. This quality was of great assistance in corroborating results in the restoration of other writing, as footings in most additions are first entered with pencil, so the work can be checked with perfectly clear marks.

Printing is easily read, as most people have observed when a printed paper is charred. This is caused by contrast of the carbon owing to the compression of the original paper under the presses. The only difficulty in reading this matter is in obtaining the right light, as most papers come through the earbonization crumpled. The same is true of typewriting, and in a lesser degree with carbon impressions

As before stated, writing gave the most trouble, and the results of carbonization were remarkable. The chemical action of gasea accounted for this Adjacent sheets were entirely different, and parts of the same

sheet would have writing plainly visible and writing most difficult to restore

The handling of charred documents requires the utnost care. They are extremely fragile A room should be chosen that can be guarded from drafts and which has abundant sunlight, so disposed that light can be obtained from various angles.

Books and pites were held to gether by the crumpling and irregularities caused by charring, and required patience and caution in separating Statulas made of thin celluloid were found best for this purpose These were cut from sheets, such as are used for windows of automobiles, about an inchwide all corners rounded off, and the edges made round and thin by scraping Parts not having writing (such as that entering the binding, etc.) were cut away, to reduce the size of the sheet to be handled

A sheet of paper, slightly larger than the charred document, was carefully brought under the record, and in this way the latter was transferred to the water trays. These trays were made of wood, with one ond at a sharp angle, and lined with thin white oilcloth, folded to fit the tray and tacked over the edges. These trays were two inches in depth and made several inches larger than the papers to be handled.

When one side of the document had here rend, a piece of oil, loth was brought under it, and while resting on this the document was drawn over the angular edge of the tray By this means it could safely be reversed in the bath After the transcription of the document had been made, it was placed on tissue paper, dried and attached by small strips of gummed paper, for proservation.

The wetting of the charred records served a triplpurpose Very often the entire document could be read at once, it overcame the difficulties of proper lighting, and lessened the fragility of the documents.

If the writing did not become legible in this treatment, the document was removed from the bath by means of the olicioth, and brought on a thin board for convenient handling, to be treated by various chemicals. These were painted on with soft brushes First hydrogen peroxide was tried, then dilute sulphuric acid, and where these failed, alternate applica-

chemicals. These were painted on with soil measure. First hydrogen peroxide was tried, then dilute sulpluric actd, and where these failed, alternate applications of oxalic acid and chloride of lime in saturated solution. As previously stated, one of these methods enabled the reading of over 20,000 documents, but some required great patience. Since this work was

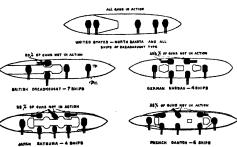
done, I have experimented and have very much improved on the above

The record is first placed in the water bath, and then in a bath of gold chloride, such as is used for coning photographs. The result is a gradual reduction of gold in the metallic form on the carbon, and very little, if any, on the written matter. The contrast can be brought to almost any degree required, and a base can be formed for viectro plating where a preservation of the document is necessary. The more diffure the gold bath is used the more uniform the deposition, but, of course, this is obtained at the expense of time. I suggest a slightly gramme gold chloride to one little gramme gold chloride to one little of distilled water. This can be varied as experience suggests. The amount of gold required is compara-

MAPAN AATSUMA —4 SMUPS

eck view of dreadmoughts, showing the greater broadside fire of United States ships,
due to our center line system of placing the turrets.

AMERICAN SYSTEM OF GUN POSITIONS IN POREIGN NAVIES



(Continued on page 884.)

Automobile Novelties

New Things in America and Europe

Street Sweeping and Sprinkling with Gasoline Motor-driven Machines

By Frank C. Perkins

THE accompanying illustration shows a novel form of American motor-driven atreet cleaner and sprinkler of light construction having a working speed of four miles per hour.

It is claimed that this gasoline motor sweeper will do double the work at a roat of less than on-baif that of a lores-haided machine (Indoubtedly the subject of street cleaning is delly becoming more important from the fact that the mileage of Javed streets throughout the country is increasing at a rate of over 1,000 miles per year. These streets must be cleaned and the public demands a more sauitary method of doing this work than has been the custom before The combinations.

tion moto-driven machine for sprinkling, sweeping and collecting the sweepings results in great economy and obtates the formation of clouds of dust which nearly always accompanies the operation of street cleaning by the old system.

This soft proposed machine has a speed when in regular commission of 4% unlies per hour against 2½ miles per hour of day teams the man only is required to dive and operate this machine, which sprinkles, sweeps and picks up the sweepings all in one operation. Three round tips will clean the entire width of the average paved street and sweep to within a few inches of the cush on both sides of the street. Thus only the natural accumulation of dirt is left in the gutter, and this can be quickly and easily gathered by hand.

By means of this motor equipment a given section of pavement is cleaned, leaving all the sweepings at the center of this section in two piles on opposite sides of the street, where it can be quickly shoveded into wagons without the trouble of following the curb line along the entire length of the street, as is necessary with the old

It will be seen that the working parts are honded in so as to prevent the dist from flying during the sweeping process. This is a very important saintary improvement in the work of street cleaning. Only county water is sprinkled on the payment ahead of the aweeper to lay the dust live this method there is said to be a reduction of 25 per cent in the cost of street cleaning as compared with any other method now in use in America.

The power of the machine is supplied by

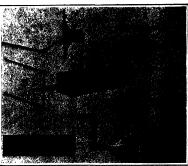
The power of the machine is supplied by a two-planed passion and the planetary translation and counter shaft motor-daily-machine with spiritude and in-closed revolving brush unquestionable representations of the problem of sanitary street sweeping.

How Automobile Numbers are Concealed

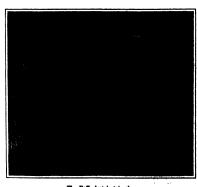
T may be questioned whether it is not a bad policy to expose fraud lest unscrupulous persons make unlawful use of the information. As a matter of fact we are in clined to think that the man who wishes to be dishonest is usually quite capable of inventing his own ingenious methods, and more good may be done by exposing such methods than by keeping them secret. In the accompanying illustration are pictured number of devices invented by automo bilists to alter or conceal their car license ers at a second's notice, so as to avoid apprehension in case of accident or viola-tion of the speed laws One of the com-monest practices, which does not require any illustration, is to oil the number plate so that it will collect dust in sufficient quantity to obliterate the figures thereon The methods here illustrated, however, call for the use of simple apparatus, which may be divided into three dis-tinct classes. The first consists in dropping the number from its usual support and letting it drag along the surface of the read so that the numbers cannot be read. The second scheme consists in turning the plate so as to bring a new aumber into view or in covering one of the numerals with a new one so that the value of the number will be changed. The third system consists in discharging a cloud or spray of vapor to conceal the number.

Fig. 1 illustrates the apparatus employed for dropping the number. The number plate is hung on pair of hooks which are held in such position as to retain the plate by means of a cord that runs to within easy reach of the chauffeur; seat. All that the chauffeur needs to do is to release the cord, when the chauffeur will swing downward and tip over, letting the number fall off. The number plate is then dragged along the ground by means of a wire attached to it under the car has reached a point of safety, when it may be

Street sweeping and sprinkling with gasoline motor-driven machine.



Some ways of concealing automobile numbers.



The Bell electric tricycle.

NEW THINGS FROM THE AUTOMOBILE WORLD

restored to its original position. Fig. 3' shows another way of performing the same operation. In this case the number is supported on a pair of rods with their ends slightly upturned. The rods are carried in sleeves so that when they are drawn into the aberea the number plate will be dropped off.

In Fig. 3 is shown a scheme borrowed from the revolving ', set car signs. The numbers are painted on three sides of a block, sech side containing a different number. By means of a pair of cords attached to a cross arm, may one of the numbers may be brought into view at a moment's notice. The method of changing an individual figure of the number is shown in Fig. 4. One of the figures on the 'piete is concessed by a tilm metal sheet bearing a different numeral. By operating the cord the books which hold this numeral are released, letting it drop of so as to

expose the figure beneath, and thus alter the number. The system of obscuring the number may be accomplished as shown in Fig. 5, oither with steam or with gasoline vapor from a cylinder_arranged for the purpose. The valve controlling the spray is looated within convenient reach of the chaffour's seat so that he can hide the number whenever desired.

The Beff Electric Tricycle By Jacques Boyer

Automobilities propelled by gasoline dark validities and to touring. For use in crowded city streets, however, there is a growing demand, encouraged by municipal authorities and by public opinion, for light, nolseless and indoorous wholices, offering the greatest possible security to pedestrians. In these respects electric vehicles are the best, and they should ultimately supplant all others in city streets. Every improvement in this line decerves attention. The new Beff electric tricycle has been adopted by two great Paris shops, "Le Printemps" and "Le Louvre," for their delivery services.

Hitherto, electric vahioles of all kinds have shown the massive construction of gazoline cars designed for bad roads, and their great dead weight has necessitated enormous expense for tires and current, as well as exaggerated dimensions The Best tricycle is designed to remedy these defects. Its most original feature is the system of control by means of the front wheel.

In the construction of motor tricycles the mounting of the motor presents serious difficulties. It is usually placed on the fork in front of the frame, but this arrangement necessitates the employment of heavy and bulky connecting mechanism, complicated in construction and operation.

The motor of the Best tricycle is attached to the front wheel, as the photograph shows. The battery, which is concessed beneath the seat, consists of 22 accumulator cells, each of 22 volts, and has a capacity of 150 to 180 ampers hours, which suffices for a run of 30 or 40 miles at a speed of about 10 miles per hour, which is quite fast enough for city service.

The cost of charging the battery is about 70 cents. The one-seated delivery tricycle weighs about 1,100 pounds, and is capable of carrying 130 to 350 pounds, in addition to the driver. It involves little synesse for tires, because of fts remarkably light weight. Tricycles with seats for two and four persons are constructed on the same principle.

The Best fricycle possesses an absolute certainty in operation, due to the great simplicity of its construction and the slimitation of the differential and speed changes; remarkable facility of control, owing to its snall dimensions and the fact that it is stopped and started by moving a single lever, so that its course can be abruptly arrested and turned, aimonet artight angles; and a stability that withstands all bests. The bruke is applied instantly by means of a pedal, and the motor is wavereast as

The Variable Speed Aeroplane

Some Ingenious Designs

T the instigation of the Marquis de Dion, the A resemble fourmai Auto has offered prises for sero-planes which can travel over the same course with the most which can travel over the same course with the most which y varying average speeds. The object of the competition is to promote safety in aviation by handing at low speed. The greatest variation in speed appears to be possessed at present by the swittest asroplans, the 100 horse-power Biériot, which at Bel-mont Park started at about 50 miles and attained a maximum speed of nearly 70 miles per hour. The Briggust aeroplane, however, can vary its speed greatly by changing the inclination of its sustaining surfaces, and will therefore have an advantage in the competition over more rapid machines with fixed wings, if it is permitted to land and adjust its wings between es. It is not always possible to find a safe

and the danger of fanding increases with the velocity. Nine-tenths of Blariot's numerous accidents occurred in landing According to sero plane constructors the minimum speed on striking the ground, with motor stopthe motor stop-ped, is threefourths of the starting velocity. For the swift Bieriot this would be 37 miles per hour. The disas-trous effect of striking a slight elevation of the ground at such a vertical velocity of 10 or 12 feet per mecond, is easily imagined, increases with the size of the machine.

landing place.

develop ment of the sero plane depends mainly upon this factor of safety. It is claimed that there would be no inherent difficulty in combining 40 Bréguet biplanes to form a great airship which, though only half as long as a large dirigible, would be able to carry a useful load of 12 tons, or at least 100 pass gers, with a lib-

eral allowance of baggage. There is a great temptation to employ for landing, if possible, a water surface, which not only is level, but also forms an admirable buffer against vertical shock. Moreover, a large aero plane can be mounted more conveniently on rigidly be nounted more conveniently on risking before the many wheels and spriges. With the state of the tenses of the from the figures destroyed the cast when afost to consider his maximum speed with low electing and landing, and in emergencies, union 17 the studenting instances must be translation, so that the speed can be varied range, so that the speed can be varied the sate of the manchine department noting propeling saust be contrived to work in the same to the contrived to work in the same to the

ne driven by a constant speed explosion a maximum thrust when its blades have obligation, which varies with the speed of

State of the state

the aeroplane. For the purpose of automatically adjusting the propeller blades to the angle of maximum thrust, at every speed, flexible blades are employed by Bréguet, a centrifugal regulator by Capon, and an electric regulator by Riester-Picard. The devices of Breguet and Capon are simple, but only approximately soive the problem, while that of Riester-Picard is perfect in theory but complicated and delicate.

Bréguet's original flexible blade (Fig. 1) was formed bber cloth stretched over a series of flat ste springs, which were attached at one end to the rigid edge of the blade; but the construction was afterward simplified by adopting a rigid blade, capable of motion around its edge, and controlled by a single spring. Breguet has carried six persons with an aeroplane having a propeller of this type, driven by a an explosion motor is impaired by deviation from its normal speed.

In Riester-Picard's system (Fig. 3) each of the two blades F of the propeller is attached to an arm b, which can be turned on its axis, in the ball bearing f, by the crank m. This crank is turned by the rod a, which abuts against a sliding piece g on the hub h. This sliding piece turns with the hub and is moved along it by the collar i, which is pressed outward (to the left in the figure) by the spring c. and drawn inward by the lever P One end of this lever is pivoted at o, while the other end p is subjected to a varying pull communicated to it by the flexible transmission r either from the hand lever L or from the soft iron core t of the sucking coll R. The shaft of the propeller turns in the ball bearings u and v,

and the end bearing a receives the total thrust by the pressure of the ah on the blades This end bearing r rests agninst a com pressible vessel z, filled with oil and connected with a manameter which indicates the thrust of the propeller at every instant (The oil vessel and manometer are shown in Fig 5) Hence the pilot, by mov-ing the lever L, can always give propeller blades that inclination which will produce the maximum thrust, as indicated by the manometer

The same result can be produced automatically by means of an electric regulator The oil vessel # communicates with a small cylinder containing a spring piston An caused to traverse the sucking coil S, so that the core h tends to move and to increase the inclination of the propeller blades and the thrust of the propeller When the maximum thrust

has been obtained. however the spring piston is forced to its extreme position, in which a finger attached to the piston breaks the cir-cuit of the sucking coil. The inclination of the blades and the thrust of the propeller are then promptly diminished by the recoil of the spring e This diminishes the pressure in the oil vessel and cylinder, so that the piston recoils and re-establishes the circuit, which is quickly broken again by a repetition of the action described above. Hence the suck-ing coil is traversed by an intermittent current of short period which keeps the thrust practically at its maximum value

The propellers of the dirigible balloon "Clement-Bayard," which have given perfect satisfaction, possess some of the features described above

Riester-Picard has also designed an aeroplane in which the inclination of the sustaining surfaces can be varied. This aeroplane (Fig. 4) is a sort of double biplane, having a pair of elevating planes E at the bow, and a direction rudder G at the stern. The two biplanes are connected by a braced girder P. from which the machinery is suspended. The four slightly

Continued on page 565

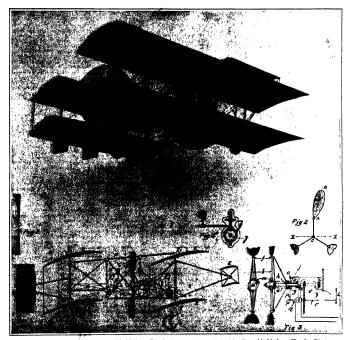


Fig. 1.—Breguet's propeller with flexible blades. Fig. 2.—Breguet's propeller with adjustable blades. Fig. 3.—Riester-Picard's propeller with self-adjusting blades. Fig. 4.—Riester-Picard's variable s NEW IDEAS IN AEROPLANE DESIGN

50 horse-power motor. Bréguet is now experimenting with a three-bladed propeller (Fig. 2) Each blade is with a three-based propeller (Fig. 2). Each blade is attached to the shaft by an arm, and is free to oscillate, under the control of springs, about three axes. At starting the blade turns on its axis of figure (AB) se as to strike the air at a very small angle and produce a maximum thrust. As the aeroplane gains speed the blade returns toward its normal posi-tion, and thenceforth automatically adapts its inclination approximately to the speed of the aeroplane blade protects itself against the irregularities of the motor by turning slightly in its plane of rotation about its point of attachment (£) to the arm, and also by rocking forward and backward, with its arm, bout the axis E.C. Capon's system of varying the inclination of the

ller blades by means of a centrifugal regulator is very simple in theory and construction; but the is very simple in theory and construction; out the inclination of the blades is controlled entirely by the speed of the motor, and is not affected by the speed of the aeroplane, unless the former is made to depend usen the latter by another regulator. This is not the usual practice; nor is it desirable, as the efficiency of

The Seventeen-year Locust or Periodical Cicada

The Two Races and When They Appear

By Dr. L. O. Howard, Chief of the Division of Entomology, Department of Agriculture

O NE of the most interesting insects in the world is the American periodical Cleata, or so-called sevent-en-year locust Ever sevent-ener years in given localities in the Northern States, and every thirteen years in given localities in the Southern States, this sizable but rather frall insect comes out of the ground in great numbers—somethmes in in-redible numbers—and for a few weeks pherees the air with its shrilling. It sometimes happens that in certain localities it will appear at more frequent in-tervals. Thus in 1902 it appeared in parts of Maryland, New Jersey and Eastern Pennsylvania, and in the present year [1911] it will again appear in the same general region. But this does not mean that show which will appear this year are the children of those that laid eggs in 1902, they belong to a different brood, and their immediate parents were friging and singing and laying their eggs in 1884, while the children of the 1902 brood will not since as adults until 1919.

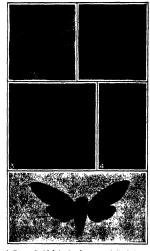
There are many of those so-called broads, all accurately mapped, and their appearance from time to time can be predicted with certainty. The seventeemap was broad of the present year, for example, running from North Carolina up to Albany, New York, and occurring also in Connecticut, has been reported every seventeen years since 1724 in Connecticut, and in New Jersey since 1726. Many changes have co-curred in the 187 years elapsing between 1724 and 1911. Many a generation of Cleads larves have gone into the ground for their long years of larval life, energing at last to the aurface only to find in many instances that in the seventeen years a house or a pared attreet or possibly a whole town has covered the surface.

There are thus two distinct races of the periodical Cicada. The northern, or seventeen-year aree stays under ground seventeen-years, except for a few weeks the southern, or thirteen-year race occupies only thirteen years in its subterranean growth. And occasionally, as will happen the present year, a brood each race will make its appearance. On the whole, for our reason or another, most of the great broods are growing smaller. This is due in part to the grad ual change in the face of the country through civilization, and partly, in our cities, to the work of the English sparrow now become so annoyingly abundant Exact records of the appearances of the Cicada

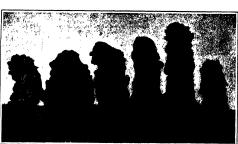
have been kent for many years, and it is therefore possible to predict their appearances with exactivates for many years to rome. In 1912 they will come out over most of lows; in 1913 in Southwestern lows and southward through Eastern Kansas and Western Missouri into the Indian Territory and possibly into Texas. In 1914 a compact brood will appear all through Eastern Ohlo and over most of West Virginia, and in 1915 a seat tering brood will be found through Wisconstin, Mehigan, Illinois, Indiana, Ohlo, West Virginia and south

The alarm always caused by the appearance or announced appearance of this insect is largely unjustified. They take practically no food, and injure tree only by the unfortunate way in which they lay

their eggs. They begin to come out about the end of May or early in June, and are active as adult Cleadas for four or five weeks After mating, the female lays her eggs by working her strong ovipositor into tender twigs of many different kinds of trees, inserting her



 Pupa. 2. Adult issuing from pupa shell. 3. Later step in the same process. 4. Adult just after leaving pupa shell. 5. Mature adult cicada.



Earth cases of larve.



Earth tubes of larve coming to the surface too soon.



Holes in the ground from which cleades have issued.

A PERIODICAL INSECT PAST

eggs under the bark and in the sapwood in a line along the axis of the twig.

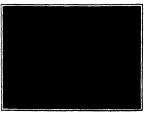
Twins thus attacked usually dis, and where the Cloads is numerous these terminal twins with dead leaves are frequently so abundant as to make it appear as it a patch of woodland had been seriously injured. The eggs begin to hatch late in July, and the active little larves drop to the ground and burrow he neath the surface, where they remain until the end of May of the seventeenth year thereafter. Those larves are not grub-like, but are active, four-legged creatures, and burrow readily through the soil by means of enlarged forelegs. They do not seem to injure the roots of plants, but to derive their sustemance from the organic matter contained its soil moisture.

In the late apring of the seventeenth year, they have passed through their last mold and have become pupe, but in this stage they are as active as before. Sometimes reaching the surface of the soil, they will built little cones or chimneys of earth above the surface of the soil, building upward continuelly for several build these chimneys or turnets or built, as they have been called, has been a puzziling matter for the people who have written about it. They seem to be made when the soil is shallow or when there is some unaut warmth which brings the pupes to the surface in advance of the normal time and also sometimes when the soil is cascalively moist. The conditions, in other words, must be somewhat abnormal or the chimneys are not constructed.

When the proper time arrives, the pupe have the when the proper time arrains the ground almost with a runh. They all come out nearly together and acramble for some tree trust or fence or bush. On such base they climb upward for a constant crails distance and then settle hold firmly and rest. This scramble from the ground begins always just sundown and continues until nike or ten o'clock in the evening. About an hour after they have risen and fixed themselves, the skin begins to burst along the back of the thorax and the adult Cloads alovy! crawled to the control of the distance is complete, and the newly issued adult, white in color with red yeas, clings either to the pups shell or to the bark of the tree or to the other object upon which the pups may be fixed, and gradually the wings

expand and dry, and during the night the dark brownish color of the insect becomes evident.

The Cleads has not many natural specific enemies, and this is quite to be expected from its rare appearances. Nevertheless, many birds feed upon it with avidity, and the English sparrow, rather contrary to its normal habits, seems to begin a prolonged feasing whenever the Cleads comes. So generally are the Cleads actored in the neighborhood of cities by this city nuisance that such year the broods have become smaller since this sparrow was brought to this country. One of the natural enemies is the largest of the digger wapp, Spherius specious. This wapp stores its burrows with Cleads. The periodical Cleads as a rule appears too



Pupa cases of cicada

A CONTRACTOR OF THE PARTY OF TH

sariying the wasn, which finds the bulk of its prey in the common deeday harvest fly that comes out after the swentemprear locust has disappeared, but many of the late-flying seventeen-year Cleadas are captured by the sarilest of the waspe to issue, are stung by them and carried away and packed in the long wasp purrows beneath the ground.

The eggs of the Cloads are preyed upon by certain mites, and there is a little internal parasite which destroys them as well.

It amentimes happens that orchards located on cleared lands or in the vicinity of standing forests are varieties; but on the whole they do sittle damage. Where damage of this kind is feared, the remedies consist in carrotroping the pupe as they arise from the ground and while they are more or less torpid and sluxgish. A very strong solution of keroene emulsion has also here used with excellent effect. It should be sprayed over the pupe and newly formed solutis in the early evening. A heavy coat of whitewash on the trees will keep them away to some extent when there are other trees in the neighborhood. Bordeaux mixture seems thave some effect of the same kind. Owners of young orchards, forewarned of the coming of a brood of Cacdas, should neglect all pruning operations during the winter and spring in order that their trees may be pruned for them by the Cleadas, thus distributing the damage over a larger surface. Another precultion when a Cleada year is expected is to defer the planting of orchards, especially in the vicinity of old forest land, until the danger is past.

Forests and Water Supply By Russell L. Dunn

To HE source of all the water on the land surface to the earth and beneath it is the water vapor diffused or held in solution in the atmosphere. The condensation of the water vapor results in the change of the water from the gaseous to the liquid state, in which condition it is beavier than the atmosphere, and gravity operating it falls to the land surface, arriving there, dependent on the temperature and relative dryness of the atmosphere it falls through, either in liquid form as rain or in solid form as new.

That portion of the water precipitated on the land surface which runs off from the surface by gravity to the sea is "water supply," and the other portion is "water water." The latter includes water which is evaporated directly back into the atmosphere from the surface of snow, water which is evaporated directly back into the atmosphere from the land surface, water which is evaporated back into the atmosphere indirectly from the land surface, water which is evaporated back into the atmosphere indirectly from the land surface, water which is evaporated back into the atmosphere indirectly from the land surface, making the leaves of trees and vegetation generally, and water which becomes fixed in the structure of vegetation, the trunks of trees particularly Water supply includes water which runs off the land beneath the surface and water which pussing first water water and water which pussing first surface water and water which pussing first surface water and water which pussing first water and water which pussing first water and water wa

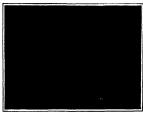
It has been maintained that the forestation of land in comparison with its non-forestation increases the quantity of "water supply" and decreases the quantity of "water waste."

Consider first the case of water precipitation which comes on to the land surface as rain. Orthously, if rain falls on impervious rock or earth surface it runs of from that surface undiminished in quantity, substantially all of it becoming water supply except the quantity surparted directly from the surface of the water as it runs off by gravity. On the other hand, if the rain falls on a pervious surface, that is a surface composed of rock or soil particles with voids be tween the particles, the water seeps or percolates into the surface by gravity until it has filled the voids and thereby made an impervious surface over which any additional precipitation of water runs off precisely as it would from an impervious rock surface.

Obviously, the forestation or non-forestation of the pervious land surface does not determine the quantity of water which enters that surface. The quantity of water entering the land is determined by the cubic space quantity of the voids between the soil particles. That is, no more water enters the land when it is not forested than when it is not forested. Also, the quantity of that part of the water supply which is run of water by gravity without entering the land at all is the same quantity whether the land is forested or is not forested.

But, of the quantity of water which percolates into the soil velds from the precipitation, only that portion, is water supply which reappears from the discharge of the volds by gravity, the remainder being water waste. The question of forests increasing the water waste thus becomes limited down to the proposition of whether or not the voids in the soil discharge more water by gravity through springs back to the surface when the land is forested than when it is not forested.

As between land forested, and land not forested, the larger water waste quantity made by direct evaporation from the land surface is from land not forested. The shade of the forest keeps the surface of the land betseath it from receiving as many heat units from the sun's direct mays as the unprotected surface would receive. But the heat units which the land surface shaded by the forest does not receive directly are nevertheless received indirectly by the land surface through the leaves of the forest trees. The heat units of the sun's rays are mether more nor less in quantity by reason of the forested condition of the land, but are the same quantity. Those heat units



Members of the staff of the Bureau of Entomology dig ging for cicada larve on the Agricultural Department grounds at Washington.



Eggs of the cicada as deposited in the twigs of trees



Cicadas laying their eggs in twigs and twigs showing

PHASES OF THE 17-YEAR LOCUST'S LIFE

that implings directly on the land surface become conserved into work which can be expressed in terms of water evaporated directly from the soil voids. The heat units that implings on the tree leaves become conserved into work which can be expressed in terms of the water fixed into the tree structure, both quantities of water evaporated from the tree leaves and in terms of the vater fixed into the tree structure, both quantities of water being obtained from the soil voids. The total quantity of water waste evaporated from the soil voids bears a direct relation to the number of heat units the more water evaporated, and it is quite obvious that whether these heat units become conserved into work directly in the soil voids where there is no forest cover, or indirectly through the tree leaves where there is forest cover, the total quantity of work conserved from heat and expressed in terms of water removed from heat and expressed in terms of water removed from heat and expressed in terms of water removed from the soil voids is the same.

Obviously, if the quantity of water percolating into

the soil voids is the same quantity whether there be forest on the land or no forest, and the quantity of water waste deducted from it by the sun's best units conserved into work is the same quantity whether there he forest on the land on no forest, then the quantity of water supply with romains after the deduction of the water waste to respipear through the gravity discharge of the soil voits is the same quantity whether there he forest on the land or no

Consider now the case of water precipitation which comes on to the land surface as snow. After the snow has melted and become water the preceding analysis applies. The forestation or non-forestation of the land does not affect the quantity of water supply from melted snow water.

Before the anow mells, during the period of temperature below the melling point of snow, there is a water waste from the anow by direct evaporation from it, but, as the temperature when below the anow melting point is, if different at all, higher outside of the forest sheller than under it, the water wasterom unmelted snow may be a larger quantity where the land is not forested than where it is forested. The difference of quantity of water waste from unmelted anow outside of forest cover and unmelted snow within forest cover is, however, so relatively small that the effect of the forest is practically nothing on the quantity of water supply provided from snow precipitation.

It has been maintained that the forestation of land in comparison with its non-forestation retards the melting of anow, that snow melts slower where it is precipitated on forested land than o non-forested land, and that therefore flood stages of run off of water from melting snow are not as high wherees the the melting snow is under forest cover as where the melting snow has no forest cover.

The melting of snow bears a direct relation to the heat units which the snow receives. Where there is no forest cover, the heat units reach the surface of the snow, and, absorbed by it, become conserved into work expressed in terms of where melted from snow. As the water is produced at the surface of from snow. As the water is produced at the surface of the snow, it leaves the surface by gravity. Populary an unmelted surface of snow, which in turn melts and passes from the surface by gravity. But all of the melting time there is only one surface of the snow,

the top, receiving heat units and melting. Where there is forest cover a less number of heat units reach the surface of the snow, the top, but the bottom of the anow also receives next units and melts. The heat units which reach the bottom of the anow also receives next units and melts. The heat units which reach the bottom of the anow and carried by the descending sap to the tree roots, where they become released in effecting chemical changes in absorbing plant food from the soil along with their water carrier. The released heat units radae the temperature of the soil above the melting point of snow where the two are in contact, and the snow melts on the surfaces of contact, the water produced passing a wazy from the snow by gravity leaves an unmelted surface against the warmed soil and the process its repeated.

In the forest during the period of greatest rate of growth of the trees the heat units released and becoming sensible heat in the soil are a larger quantity than the difference between heat unit quantities received by the top surface of the snow where there is no forest cover and where there is forest cover The increase is due to the conservation of heat from The increase is due to the conservation of neat from chemical combination in the soil in the process of di-gestion of plant food The increase is not a large quantity, but it is sufficient to cause the melting of snow from beneath a forest cover at a more rapid rate than when there is no forest cover. This phe-nomenon is a matter of very ordinary observation. The observed fact agrees with the conclusion of a deductive analysis concerning it. Instead of the for-esting of land retarding the melting of snow as com-Instead of the forpared with the melting of snow on non-forested land the fact is the reverse, the forest cover of land accelerating the melting of snow beneath it and thereby causing higher flood stages of run-off water than the run-off from melting snow where there is no forest.

Let us study two fields of similar surface lyting contiguous, one of the two being planted with a clover, for example, slifts, the other being clear of vegetation of any kind. The snow cover will become melted from the alfalfa field sooner than from the barren field. The affalfa will begin growing before the snow is entirely melted, and will disengase heat in growing which will start melting the snow at the bottom Both fields receiving the same heat on the top surface of the covering snow would become cleared by the melting of the snow at the same time except for the heat received by the snow on the alfalfa field at its bottom surface accelerating the rate of snow melting. atticulum artistection of the property of the second of th

Correspondence

The American Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN:

I have read with much interest the articles in your issue of April 29th on the American merchant marine. Having formed some decided opinions on the subject, I avail myself of the invitation which you excriticism and publication

My opinions are the result of an analysis of the statistics of the United States government and reading and observation.

Having traced from the statistics the lost American shipping into the hands of foreign competitors, I realize how it has been distributed among them, and which foreign, country has received the lion's share.
In reference to the plea that in considering the

question of restoring the American merchant marine, we must include the upbuilding of American ship vards. I submit that it should first be shown that

varia. I simmly that it should have be shown that those yards are owned wholly by American citizens I have discovered that the protected cotton thread industry is owned by English capital, and has been so owned for many years, such foreign ownership being runningly concealed under American corporate titles; and as many other industries have also passed out of American into foreign ownership, it is reasonable to assume the probability that to some extent the American shipbuilding plants are similarly owned by for-

A petition has been presented to President Taft by the writer, seeking relief from the established system

whereby the American people as consumers are compelled to pay tariff taxes to foreign investors whose interests are located in the United States.

It seems to me nat the memberthat the member-ship of the most prominent business organizations in the country, organiza-President and Congress turn for in-formation and advice as to legisla-tion affecting the most vital needs of the people, should be critically examined, and the na-tionality of the interests represented those members who are the agents of the foreign steamcompanies which are enjoying

the business that Americans have lost should be pub licly announced in all proceedings where their activities are exerted and their names are mentioned, and this publicity should be most plainly shown in all communications presented by those business organiza-

There is every reason for believing that the representatives of the foreign shipping lines have taken and will continue to take, every advantage that their membership in American business organizations ofters to detest all measures that might result in retaking the foreign carrying trade from them and restoring it to American ship owners. It would appear that they have secured such membership for that purpose.

If the American merchant marine is ever to be restored, the powerful influences of the foreign steamship companies, secretly exerted under the titles of Amrican business organizations, must first be broken by publicity.

or the advancement of the interests of American investors, it is essential that alien interests in the United States, amounting to about seven billions of dollars, shall be identified at all times by the nationality of their owners.

The Free Ship Question

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 1st is an article deplori the decadence of American shipping and proposing the revival of preferential duties.

This would be all right; but would it not be simple: for Congress to pass a law giving to American citizen the same right to buy and run vessels as is enjoyed by the citizens of Sweden, Denmark, Italy and other European countries? It is claimed that American citIf this simple law were manual, it would note this whole question, and would note cover the same with our flag, as they were in 1810. We substition no prefer ties, no other coddling of any kind be needed.

Our ships now are sailing the seas, but they are no allowed to fly the American flag. It is a humiliating fact that when an American merchant goes into the shipping business he must go to Eugland or a European country and ask for a flag to fly on his ships, if he wishes to avoid bankruptcy.

Under our present navigation laws, no American wher can operate vessels without higher freights Higher freights mean lower prices for farm produce So it is better for the American farmer to he produce carried to market in an American ship flying the British flag, and receive good prices therefor, than to have it carried in the same ship, under the American flag, and receive poor prices therefor.

Riverton, N. J. FROM GROWER.

The Future Population of New York

To the Editor of the SCHETTING AMERICAN: Herewith please to find a map prepared at my in stance to show the present and estimated future popon of our five boroughs.

These estimates are believed to be conservative. even in view of the undoubted increase in the num ber of persons who will use existing and contemplated transporting passer their homes outside the city limits.

The purpose of the map is not to support or furthe any pian of rapid transit under consideration, but to

The desirability of establishing- n -plans for a com chensive and con sistent system of rapid transit, Among the essentials of such a system are: That it shall be adequate to meet future needs so far as they n; that can be foreseen; that it shall tend toward more nearly uniform per acre density of opulation as tween the boroughs. and that it shall ren der easy the separate construction of different parts of the entire system in order of urgency financial return. The profit likely to accrue to those who shall furnish terial additions maexisting transit fa-cilities thus planned. And 3. The sociological need





GREATER NEW YORK, 1910-1940

The figures printed on each borough show total population: Actual for 1910; apportioned estimate for 1940 Compiled by Waiter Luidiaw, Ph D., Executive Secretary, Federation of Churches, April, 1911

izens are free; why, then, should they be handicapped in this respect more than the citizens of any other civilised or even barbarous nation on the earth?

for such additions. New York, N. Y.

L. E. OPDYCKE.

Rules Governing the Competition for the \$15,000 Flying Machine Prize Offered by Mr. Edwin Gould

1 A prize of \$15,000 has been offered by Mr. Edwin Gould for the most perfect and practicable heavier-than-air flying machine, designed and demonstrated in this country, and equipped with two or complete power plants (separate motors and propellers), so connected that any power plant may be operated independently, or that they may be used together

CONDITIONS OF ENTRY

Competitors for the prize must file with the Contest Committee complete drawings and specifica tions of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Such entry should be addressed to the Contest Committee of the Gould-Scientific American Prize, 361 Broadway, New York Each contestant, in formally entering his machine, must specify its type (monoplane, biplane, belicopter, etc.), give its principal dimensions, the number and sizes of its motors and propellers, its horse-power, fuel-carrying capacity, and the nature of

s steering and controlling devices.

E. Entries must be received at the office of the

SCIENTIFIC AMERICAN on or before June 1st, 1911.
Contests will take place July 4th, 1911, and following At least two machines must be entered in the contest or the prize will not be awarded.

CONTEST COMMITTEE,

4. The committee will consist of a representative of the Scientific American, a representative of the Aero Club of America, and the representative of some technical institute. This committee shall pass upon the practicability and efficiency of all the machines entered in competition, and they shall also act as udges in determining which machine has made the best flights and complied with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

CONDITIONS OF THE TEST

Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and propeller independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be alto compete unless it can fulfill these req ments to the satisfaction of the Contest Committee. The prise shall not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and

for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight alternately and to gether. Recording tachometers attached to the motors probably be used to prove such performance.

In the judging of the performances of the various machines, the question of stability, ease of control and safety will also be taken into consideration by the judges. The machine best fulfilling these conditions whall be awarded the prize.

- 6. All heavier-than-air machines of any type what ever—acropianes, helicopters, ornithopters, etc.—shall be entitled to compete for the prine, but all ma-chines carrying a balloon or gas-containing envelope for purposes of support are excluded from the com-
- 7. The flights will be made under ditions of weather. The judges will, at their discretion, order the flights to begin at any time they may see fit, provided they consider the weather conditions sufficiently favorable.
- 8. No entry fee will be charged, but the e must pay for the transportation of his muchine to and from the field of trial.
- 9. The place of bolding the trial shall be de-termined by the Contest Committee, and the legation of such place of trial shall be emounted out or about June 1st, 1911. A STATE OF THE STA

The New York Public Library

How the Readers and the Books are Distributed in the New Building

"Histories of New York city and the Tillen Trust were consolidated into the New York Public Library. New York had nothing much to beast of in the way of a sellentian of beoks comparable in magnitude with that of the British Museum, the Bibliothèque Nationale of Peris, or the imperial Library of St. Peterburg, At that time the coasolidated library contained shout 383,000 volumes. New it includes, in its reference department alone, about 300,000 volumes to \$00,000 volumes \$0.000 prints, two picture galleries, and a large collection of maps, de the forty branch circulating libraries nearly 300,000 additional volumes are contained. When the coasolidate, of the Astor and Lenox libraries and the Tillen Trust was effected, the need of a single structure, which would not only house the Astor and Lenox collections, contained in buildings far distant from each other, but which would also have ample provision for increasing the number of volumes year by year, became more than ever apparatu. In 1897, the first rough sisted of the proposed library was drawn by the director, Dr. John S. Billings, Now, fourteen years later, the building stands, a realized dream.

Situated on the site of the old Croton Reservoir in Bryant Park, one of the most @cossible locations in the city, the white marble structure looms magnificently into view as one travels down or up Fifth serume. Designed in the modern Renaisance style, the building is 320 feet long, 270 feet deep, and is built around two interior courts, each about 50 feet square. The cost of removing the old Croton Reservoir, and of constructing the new building, was about nine million dollars.

The books are arranged in seven tiers of stacks, cosupying the greater part of the rear of the buildins. Contrary to the usual library practice, the main reading room is placed on the top facer at the rear, and immediately above the main stack room, with the result that better light and pointer vession are obtained. For those students and readers who use this library for more than brief and eccasional reference, special reading rooms are applied, so arranged that the books which they contain may be available for use in the main reading room, and yet permit surrestricted access to the special students. The administration quarters are sharply divided from the stacks and the reading rooms, the executive force being quartered in the south side of the library and the reading public and the volumes on the east, north and west sides.

and west stoses. The library, as it stands, has accommodations for about three million volumes, and over 1,700 readers. Its reading rooms are open to the public every day and every evening. The large reading room for the use of the general public has a seating capacity of 768 persons, and contains about 30,000 robunes of reference, accessible on open shelves. This reading room, as well as the periodical room, the newspaper room and the exhibition rooms, are open to every one fiscell students in science, technology, sociology, public documents, Oriental history, literature, music and the like, may pursue their investigations in special rooms, each of which may be regarded as a special therapy in testif, planned so that it may be used without interference from the activities of the main reading room.

Although the new library is not devoid of mechanical apparatus for the quick handling and delivery of volumes, the necessity of supplying books for all classes of readers readered it advisable to devise an architectural plan and an executive system which would distribute the reader rather than the volume which he reads Accordingly, we find the catalogue room serving as an antercom to the main reading room. Any of the 6,000 gathogue trays may be taken out and consulted on one of thirteen tables. After hards the second of the control of the control of the reference librarians satt the reader hands it is one of the reference librarians state the reader, in consecting the card catalogue, and in showing fibed the which fill brief is to be used. The reference librarians state the reader; if necessary, it assussiting the card catalogue, and in showing the how the library is to be used. The reference librarians state the reader; in the reader of the card of the catalogue, and in showing the same number, and the reader is cately in the same number, and the reader is the same number, and the reader of the catalogue of the main reading the country of the control of the

Market Linds

fisahed on the indicator his books are ready for him. The cbeck is exchanged for the volumes that he has ordered. Instead of taking the books himself from the delivery desk, the reader may have them delivered to him, if he will indicate by number on his blank what seet he has taken.

In order to obtain the book ordered by the reader as quickly as possible, a very simple system of pneu-matic tubes, lifts and conveyors has been installed All told, there are eleven electric book lifts, of which only six need here be considered, since only they are directly concerned with the transferring of books from the stacks to the reading rooms One of these book lifts travels from the stack floor No 1 to the main reading room at the north end At the south end of the stack room another lift travels from stack floor No. 1 to the main reading room. These end lifts serve the end rooms only, which are devoted to newsrs, patents, science, and technology. In the center the stack room is a group of four elevators, traveling from the first stack floor to the main reading Each of these lifts can carry 250 pounds of ooks at the rate of 150 feet a minute, and each is so arranged electrically that the pressing of a push button at any landing will stop the car at that landing, or send it to any other landing, where it will stop sutomatically.

The four center lifts in the reading room, within the delivery desk inclosure, are so arranged that their control can be wholly centered at the reading room, with one operator in absolute control of all four lifts, and with all the other operating points on the various stack floors switched out. When one station is operating a lift another cannot interfers with it until after it has reached the destination, except that the center station on the reading room floor can change the destination, if desired. Automatic switches and latches are provided on the doors opening into the lifts, so that when any door in the shaft is open, tho car cannot be moved. No door can be opened unless the car is at that particular landing.

On each of the seven stack floors is a bell tot manuscusce the arrival and stoppage of any of the four central cars at that floor. The bell does not rings when the cars pass the floor. The bell is disconnected until the arrival of the car, the bell is disconnected until the arrival room lights are used instead of bells for each of the reading room. In the reading room in the reading of the control of the cars o

The reader's slip is shot by means of a pneumatic tube system, from the information desk in the cats logue room, as we have seen, to the inclosed dalivery desk in the reading room. Here it is removed from its carrier, examined, and sent by another pneumatic tube to the proper stack. When the book is located, it is placed upon one of the four lifts in the center and sent up to the reading room.

In addition to the lifts for raising and lowering books from the various stack floors to the reading room, two horizontal conveyors have been installed on the sixth stack tiet; running at right angles to each other. One of these horizontal conveyors runs along the north side of the building; to the center of the north end of the building to the center of the stack room. The books can be transforred from the one horizontal conveyor to the other, and thence to one of the four electric litts, which carry it to the reading room. Bach of these horizontal conveyers consists of an endless track, with an endless rope running above it attached to two cars or baskets on wheels. The cars can change piaces and also stop at about half-way between the end stations. Both conveyers are driven from a main sheave at the document room and. The conveyers are operated by push buttons. The cars stop automatically at the end stations, and can be brought to a halt at any intermediates station by means of push buttons. The cars stop automatically where they are sent.

Limitations of space prevent any elaborate discussion of the various departments of the new library. Little more than a mere enumeration can be made in the basement will be found a newspaper room

in the measurest will be louing a inwapaper room provided with sloping racks or stands for current newspapers, and large tables for consultation of bound volumes of newspapers. In the library has one of the largest collections of files of old newspapers in the country. At present only about fifty important current newspapers are subsertibed for, but the room, which measures 110 by 35 feet, will have space for 200.

The circulating library is a room 80 feet square in the basement, with shelving space for 20,000 volumes. The books in the stacks, however, are also available for circulation, for which reason the circulating room is in direct communication with the stacks.

Children's rooms and libraries are by no means new; but the new library has perhaps the best of the kind ever designed. The low book shelves that line the walls, the low tables and chairs, the cozy window seals, all of them suggest the library for children's

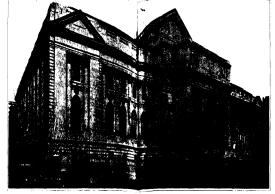
are the office, lecture room and class room of the Library School; a white marble exhibition room, 80 feet square, for the display of bibliographical treas-ures; reading rooms for current periodicals, having a total seating capacity of 100, in which rooms about 7,000 current periodicals, covering all subjects in all languages, are instantly available; technology rooms, in which 50,000 volumes are shelved for the use of engineers, patent attorneys, chemists and other investigators in the field of applied science; two r for the science collection, in which are shelved the 50,000 volumes in the library relating to the mathematical and natural sciences (astronomy, physics, chemistry); a library for the use of the blind; six study rooms for students and investigators who will spend some time in the library and who must refer more or less constantly to several hundred volumes at a time; special reading rooms for the consultation the Slavonic, Jewish and similar collections; a reading room for economics and sociology, shelving volumes and seating twenty readers; a magnificent public document room, which contains 80.000 volumes, and which is perhaps the finest collection of its kind in America; a room devoted to 20,000 volumes on local history and genealogy; two rooms for the collection on music; rooms for the exhibition of prints and paintings; a room for the Stuart collection of books, paintings, minerals, shells, bric-a brac, formerly kept in the Lenox library; a room for 20,000 volumes on art of architecture, a for the study of prints and photographs, with a working space for artists who wish to copy in paints: a map room, in which are kept some extremely valu able collections; three rooms for Americana, in which will be found the most complete collection of its kind in the world, with 20,000 volumes on American history

This cursory description of the plan of the library will show how admirably the needs of different readers have been kept in mind, how the man who desires a mere definition, a brief summary, or who desires simply to browse about, is given ample opportunity to satisfy his whims, either in the periodical room or the main reading room, how the scientific investigator, the engineer and the patent attorney, and the student of history or Oriental languages, are referred to separate rooms where they may pursue their studies quite apart from the general readers in the main reading room; and how a special student who must use the library for weeks at a time may have the use of a small room entirely to himself; and lastly, how the reader who desires to draw upon the circulating library is kept away, not only from the special students, but also from the main reading room itself. Following the suggestions of the director, the architects, Messrs. Carrère and Hastings, have pro-vided a building which is not only a work of art in itself and a worthy monument to the largest city in the western hemisphere, but which automatically, we may say, divides the thousands of readers who wish to consult the books into the intellectual classes in which they belong.

Corrosion of Iron Machinery

ARNER and Davey, in England, have investing and the corrosion which is observed in from machinery employed in certain industries, especially in the production of luminating gas. No seroid expension is caused by the cold ammoniacal liquored but the tar may corrode the distilling tunes. The effect is due chiefly to the presence, in the tar, of the chloride, sulphide and cyanido of ammonium, which are dissociated by the elevation of temperature. The parts of the tubes that are corroded most rapidly are those which are subjected to irregular deformation in consequence of alternate expansion and contraction, due to chances in temperature.







One of the side extrances.

General view of the New York μ_{nble} fabrily from the Fifth Avenue side.

A portion of the façade



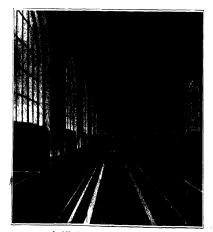




The entrance looby finished in white marble.

The delivery desk in the train reading room

An exhibition room.



One end of the main reading room, showing the delivery inclosure in the center.



One of the fying skip wer leading to the second flow.

THE NEW PUBLIC LIBRARY OF THE CITY OF NEW YORK



The periodical room,

Pustographs by Floyd E. Baker.

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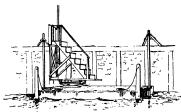
N Handy Man's Workshop of May 6th we called upon our readers for simple methods of reboring an upon our readers for simple methods of reboring an engine cylinder in a lathe. Much to our astonish-ment only one response has been received so far. We should have received a dozen or more from which several could be selected for publication. Of course the articles selected will be paid for.

The Handy Boatman By Albert F. Bishop

THE following suggestions may prove serviceable to the handy man who owns a small boat.

A Landing Float.—It is not always convenient to

place a landing float out in the stream twenty feet from the main dock so that it may be connected therewith by a long inclined "brow" or gangway The accompanying sketch illustrates a float built by the writer which was placed alongside the dock, where it took up but little room and was readily accessible at any time, as the steps were always dry and clean. The float in rising and falling with the tide carried The next in rising and failing with the title carried the steps with it. The upper part of the framework of the steps was arranged to slide up and down a pole which ran to a considerable height and was used as a The steps were connected to the float by of universal joint. Two cheek pieces were nailed to the bottom plank of the steps to support a pair of trunnions made of gas pipe. These extended



Handy form of landing float.

lengthwise of the float, whereas another pair of trun nions mounted in check pieces attached to the float were set at right angles to the first trunnions. A frame situated between the steps and the float was hinged upon the two sets of trunnions, and in this way a universal joint was provided which permitted the steps to maintain their normal position regardless the steps to maintain their normal position regardless of the conditions of tide, or the roughness of the water. Had the steps been attached rigidly to a small float they would soon have been banged to pieces against the dock by the rocking of the float upon the waves. At each end of the float ropes were attached, through which vertical stakes were passed and driven into the mud. The upper ends were

and driven into the mud. Are upper ends were se-cured to the main dock.

A Mooring Sail—Launches or pleasure craft which do not carry sails always fret and labor at their moor-ings, when the bow line is attached to a stake or buoy.



Meoring sall for laun

As the sea gets rough they are sure to lie in the trough, which brings the hull broadside to the wind This brings the greatest possible pull on the mooring This brings the greatest possible pull on the mooring A gaie of wind will often part the bow line. The mooring sail keeps the boat head into the wind and will reduce the pull on the mooring fully one-half. The mooring sail is made Vehaped and attached to the atter part of the boat cover, which may easily be set by using the flag staff and putting the end through a loop or grommet which is at the peak of the sail. The illustration shows the idea pretty well. There

should be cords sewed to the after edge of the Vshaped sail. These cords are tied to the stern after the flag staff has been put in place.

the flag star has been put in piace.

Hoist Cover for Midder Bests.—The usual form of fieldhie cover for a motor boat is not absolutely weather tight In the course of a year or two the rain leaks through quite easily. Some time since the

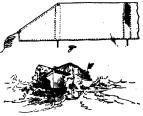


writer decided to make a cover which would hold its shape as it was tacked over a frame and hence could be holsted and fitted into place instead of being tied The hoist cover could be painted as often as de-The cover was made nine years ago. It has been used continuously winter and summer ever since and is still in good condition. The holst cover is very serviceable in the winter time when the launch is laid up. The illustration shows the framework for raising and lowering the device, which op

work for raising and lowering the device, which oper-ation may be performed much more rapidly than that of tying on the ordinary cover. The launch is moored alongside the frame. To the framework are at-tached vertical parallel rods, and small cords fastened to the boat are caught around the rod, permitting the boat to lie exactly under the cover at all times The skeleton of th. cover, which is also illustrated, is made of which is also illustrated, is made of straight strips of wood, sawed in lengths as desired. There should be feet along the bottom rit to rest on the plank sheer. The cover is tacked on the frame, sized with give water and painted with a very little white lead, but with lots of oil as well plenty of yellow orbre, which makes it a buff color If much lead is used on these covers, they are apt to crack in a few years.

In a few years.

Spray Sails—The spray sails are considered quite a convenience by those who have used them in open gasoline boats. They prevent nearly all the spray from coming aboard when the launch is headed into the wind. The sails are about 15 inches wide and two-thirds or three-quarters the length of a 25-foot boat. Galvanised iron rode 5/16 of an inch in diameter and 17 inches long are used. Holes are drilled in upper end of the rods, through which coarse twine is passed with which the upper edge of



Speak wills for a

canvas is sewed fast. It is better to place the reds canvan is sewed fast. It is better to piace the reds in sheaths which are made by sewing strips of chi-vas crosswise of the spray sall about 3 feet apart. The aboath should be about 4 inches wide on the state rod, but can be made insrewer as you go forward. Placing the rods in situation allows for a shrinkage of the canvas so that the rods can be easily set in the sockets, which are placed along the gunwale of the

lasmeh. The illustration above our of the with quite a bevel so as to give the necessithe speay sail. Both ends are deawn that is coreds which are then to the hell of the illustration made the first pair of sails shout a

How to Insert St an G By William Grötzinger

A SIMPLE tool to insert small acrews, such as are used in clock work, is made as fellows: Take a stiff place of wire and bend the and into a loop. Fut a small handle on the other end of the wire. This tool can be adjusted to different sizes of acrews, similarly the statement of acrews, similarly the statement of acrews, similarly the statement of acrews. by making the loop smaller or larger.



the screw, hold it as shown in the libratre the screw, hold it as shown in the invacation. Yea screw will then be supported steadily. After a few turns of the screw driver, remove the wire by pull-ing it. This simple tool will do away with the dis-cult task of holding the small screw with the fingers, and at the same time trying to manipulate the acrey

Shop Notes

Small Drills.—Mr. J. D. Adams, in his article of April 1st, 1911, suggests ordinary cambric needles for drills of small diameter. The ordinary needle drill drills of small diameter. The orumary needed drill if find has not drill a true hole. Now if he will make his drill from a sewing machine needle, breaking the needle at the eye and grinding it as you would a twist drill, he will have a drill that will drill a true hole, and one that cuts twice as fast as the ordinary needle drill; also one that any chuck will hold steady and true.— ELBERT S RAMSAY.

Suggestions on Hanging Doors.—I want to suggest a way of overcoming the difficulty found in hanging doors and shutters, viz., having one hinge jump of the pin while trying to insert the other. I think this job of trying to hang a door is worse than putting up stove-pipe. My idea is to have the pin or spindle (on which the door swings) about a quarter of an (on which the door swings) about a quarter of an inch shorter on one hinge than on the other. Whether the top or the bottom one is the shortest, does not matter much. One could thus hang on the end with the long pin first, and it would not jump out white the long pin mrs, and it woust not jump out writing to insert the other. At times I have had so much difficulty in hanging heavy doors that I have sawed the pin on the lower hings off a little. It works beautifully I suggest that all users of builden's hardware should sak the makers to make the hinges that way, having a long and a short one constitute a pair -- JOSEPH MULTER

A Paint Bucket Kink

WHEN a painter dips his brush into his paint bucket he always wipes it off on the edge, which after's time covers both outside and inside with paint



whether the shows in the cocompleting fluid by the cocompleting fluid fluid by the cocompleting fluid fluid fluid beats in the break angular. It is static in fall of tried path; it can be thrown and another be substituted.

and steel work in the schools to accept a position as assistant examiner in the Patent Office, and was assigned to Di-vision 14, which was his official home until his appointment as principal ex aminer in June, 1909

He completed the regular and p graduate courses in the National Law School, and is a member of the bar the Supreme Court of the District of Columbla and of the Court of Appeals of said district

in Division 14 Mr. MacNab handled the classes in Sheet Metal Work nandled the classes in Sheet Metal Working, including Sheet Metal Ware Making, Metal Bending, Metal Working Tools, Packing and Storing Vessels, Metal Ornamenting, and Personal Wear Making He is an expert, and one of the leading authorities in the art of can making, and fairly revels in the intricacles of the complicated machines which were added in large number to that art during recent years, when the class de veloped in the evolution from simple hand and foot operated devices to the perfected automatic machines of to-day.

Division 5, known as the fine arts division, now in his charge, includes music bookbinding, jewelry and harvesters. It is left to the reader to trace any relation between music and harvesters or bookbinding and jewelry The bringing together of the four classes named is consistent in at least one respect. It is clear there is no more connection between any given two than between any other two The division, however, is an important one, the music, harvesting and bookbinding arts being particularly active at all times, and all containing inventions involving mechanisms of great intricacy of operation and complication of structure for accomplishing results of the most delicate nature in instances, as in automatic musical in struments, and of producing a tremendous output in others, as in automatic bookbinding machines and in harvesters self-binders, etc.

Mr MacNab's long experience in the e, capacity for technical and difficult work, legal training and fine sense of

work, regain training and time sense of position in charge of a difficult division. Although Mr MacNab has been a principal examiner but two years, he seems like a veteran, and fits in with the radically different classes from those he previously conducted, like the covering on a well-gloved hand. We sometimes on a well-gloved hand. We sometimes speculate as to what a man would be if he occupied another position if Mr. MacNab were not a Patent Office examiner, in which field he daily demonstrate of the state of the stat strates his fitness and usofulness we hazard the opinion that he would be a bank president, Secretary of the Treasury or something else in the line for which his financial ability admirably qualifies him.

Notes for Inventors

"Squeezing" Gasoline from Natura Gas.—In the oil and gas regions consid erable interest is developing in the tracting, or as it is sometimes called 'squeezing" of gasoline from natural gas, and some patented improvements are be ing exploited. The idea of liquefying gases is not, however, a new one, and a process quite similar to that followed in some modern gasoline plants was described in the seventies by Coleman, a Scotch scientist, whose "Mechanical Refrigeration," Vol. 2, will prove a valuable reference for anyone desiring to pursue this subject more in detail.

Patents in Orange Free State Province. in one of the Washington papers there appeared recently a "special notice" signed by the Minister of Justice of Africa (Orange Free State Province), making it known that an application for filed in the office of the attorney general generating apparatus that can be placed of said government by a certain person on the desk or bench of a worker and residing at a place specified in Wash be coupled up and operated by the slee-

ington and calling upon those who might be interested in opposing the issue of said letters patent to appear at the office of the attorney general before the day of hearing specified, for the pur-pose of explaining their objections. This proceeding is doubtless in accordance with the laws of the Orange Free State Province.

A Gas Range Invention That is Needed.—In the domestic use of gas ranges by servants, much needless ex-pense is incurred by the servant leaving the gas lighted in the range when not in use, and especially is this so in some forms of range in which the flame of the burner is not visible. Sometimes the servant will leave for the night and the gas will burn until morning It seems cator or an alarm or some other mean to indicate to the householder that th gas in the range is burning. Just how this can be best effected would require invention, possibly of a high order, but the field is a large one and should be attractive to inventors working along such lines The mechanism might include au tomatic shutting off devices somewhat similar to those used for turning of lights in show windows; or cut-offs oper ated by clock work after the fashion of alarm clocks. Various other improvements will doubtless readily occur to an ingenious inventor.

The Need of a Fireproof Patent Of-fice. —Every large fire teaches its lesson fice. —Every large fire teaches its lesson and a burning like that of the Albany Capitol wherein public records are de stroyed brings home to those interested in similar records a warning that should in similar records a warning that should not be disregarded. The recorded trans-fers of interests under patents in the United States Patent Office are probably the only record evidence of the titles to millions of dollars inrecall how these evidences of title are safeguarded against fire. These records include nearly 2,250 record volumes, each containing five hundred pages and each book is fourteen and one-half inches long. twelve inches wide and about two inches thick It does not require calculation to demonstrate that considerable space is required for their storage. In addition to these records books, there are about four hundred and thirty-six Digests of Assignments in which all the recorded deeds are briefed and indexed these books are of great value to all interested in the property interests secured by patent rights and no provision what ever is made for protecting them agains fire. They are stored on wooden shelves in a hall which was "gutted" by the Pat-ent Office fire of 1877 and in the event of a similar fire it is feared the books would be destroyed, as their great num ber would render their removal imprac ticable. This condition of affairs is loubtless deplored by the Commissioner of Patents and his subordinates mor than by any one else, because they ap preciate the importance of the records and their liability to destruction. It has been suggested that that section of the old model hall be made into a vault fire proofed according to modern methods and furnished with metallic shelving of capacity to hold not only the volumes now on hand, but those which will accumu late in the years to come. It is hoped that this or some similar fireproof stor age space may be provided for thes most valuable records.

Wanted: More Ozone to Breathe. -The president of a manufacturing company in the Middle West says he is not satisfied with the atmospheric conditions in which we are living, that we need more ozone the government of the Union of South for its directly beneficial results as well as for its purifying and disinfecting actions, and suggests the desirability of patent for a certain invention had been producing a commercial form of osone

trical current of an ordinary light or power supply. Of course, ozone may be formed by the passage of an electric spark through the air, but what is sought is an osone apparatus which can handled commercially in the manne specified.

A Punching Bag that is Human.—A patent was recently issued to Nicholas W. White of Syracuse, N. Y., for a punching bag apparatus in which a punching bag is suspended from a ceiling track which is tortuous, so that when the bag is struck in addition to swinging and rebounding from the ceiling in the ordinary manner, it will travel relatively to the ceiling, and consequently the person exercising cannot judge in what direction the hag will rebound and move, and will be compelled to follow the bag in order to strike it, thus quickening the eye and exercising the legs and lowe nortion of the body as well as the arms

Legal Notes

Are "White Lead" and "Calcimin Descriptive of the Same Properties?— The Court of Appeals of the District of Columbia in March held in deciding the case of The Muralo Company vs. National Lead Company that "white lead" and 'calcimine" were not goods of the same descriptive properties In the decision Chief Justice Shepherd says: "The fact that one intending to use oil paint for interior walls calls for white lead, but may be induced to use calcimine instead upon the representation that it is cheaper and when put upon the wall cannot be distinguished from oil paint by anyone but an expert, does not make a con-fusion in trade" The decision reversed that of the Commissioner of Patents rustaining an opposition filed on behalf of the National Lead Company

President Taft as a Judge in Patent Causes.—In the white light of his present high position, we are in some danger of losing sight of the great ability exhibited by President Taft as a patent jurist, as evidenced by his decisions when sitting as a federal judge. Many of his decisions are notable, and had the bench been so fortunate as to have retained President Taft, there is little doubt he would have attained a celebrity as a patent judge equal to that of Justices Blatchford and Bradley. His facility and of expression are shown Thomson-Houston vs. Ohio, in which he

"From the earliest times, all who take part in a trespass, either by actual participation therein or by aiding and abet ting it, have been held to be jointly and severally liable for the injury inflicted. There must be some concert of action be tween him who does the injury and him who is charged with aiding and abetting, before the latter can be held liable When that is present, however, the joint liability of both the principal and the accomplice has been invariably enforced. if this healthful rule is not to apply to trespass upon patent property, then, indeed, the protection which is promised by the constitution and laws of the United States to inventors is a poor sham. Many of the most valuable patents are combina tions of non-patentable elements, and the only effective mode of preventing infringement is by suits against those who by furnishing the parts which distinguish the combination, make it possible for others to assemble and use the com-bination, and who, by advertisement of the sale of such parts and otherwise, intentionally solicit and promote such invasions of the patentee's rights."

Judge Taft's decision in Stearns vs. Russell is a leading one on the important subject of double use while that of Christy vs. Seybold is one frequently quoted to-day. When on the Circuit bench Mr. Taft's associates were Justices Day and Lurton, both of whom now grace the Su-

RECENTLY PATERTED INVESTIG These columns are spen to all patents notices are inserted by special arra-with the inventors. Terms on applicable Advertising Department of the Son

or totorest to Harm

Of Enterest to Plaraments, EAPTITT TRANSMISSION DEVICE—A Laoux, New York, N. Y. This invention to transmission gears for use on moving chines, and it is an improvement and chines, and it is an improvement and granted to Mr. Leoni. An object is to pris an efficient and durable mechanism which permit the driving number to rotte relation to the driven member when the seguing improved to a modern and means load.

of General Intere

Of General Interest.

NAME TAG FOR UMBRELIAR.—Just
Marko, Box 465, Indianapolis, Ind. This issprovement renders the identification of usbrellas casy and certain, will make it easy be
trees one in case it is lost or maistid, willipevent discussion of ownership, and will avoid
angightly marking of unbeviate by initiate.

The metals proposed to be used in making the
forerige are alumination or this absets of cop-



per, plated or spanned. It is not intended to be sold to the individual person directly. They are to be distributed among dealers in unbroiles with a pair of special pilers, and have them attach then upon making a sile. The inscriptions are to be written either by the salesman or the purchase. It could be absolved to the salesman or the purchase. It could be absolved to the salesman or the previous or on the salesman of the salesman or the purchase. It could be absolved to the salesman or on the salesman of the salesman

ICE SKID SWITCH .-- C. H. MARYELL, Sagi ICE SKID SWITCH.—C. H. MASTELL, Sagi-naw, Mich. This invention pertains to switches for los skids or tracks, and refers more par-ticularly to a switch of this class, comprising a floor over which the blocks of lec can pass, and a pivoted member associated with the floor, and mounted to swing across the same into different positions, and to defect the los laterally when it is in a predetermined posi-tion.

MINERAL BRIQUET .-- G. K. HOLLISTES MINERAL BRIQUET.—G. K. HOLLETER, JR. New York, N. Y. This briquet is formed of finely divided mineral materials, such as iron over, found in abundance in sand, low grade iron over, found in earth, decomposed rock, etc., with a binder, to permit or conveniently, economically and quickly forming the mass into briquets for almost immediate use, in a smelting furnance for smelting the mineral materials

mineral materials
INTERLOCKING BRICK.—P. Yamost. New
York. N. Y. The intention in this instrance
is to provide an interlocking brick, more especially designed for use as a fire brick in the
inlains of boiler furnances and the like, and
arranged to insure a secure and dram interdesigned to insure a secure and dram interterms of the secure of the secure of the secure of the
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noid the same from shifting in any direction.

WATER CARRIER.—J. C TRULOYS, Shoals,
N. C. The object of this improvement is to
provide a device which is designed to run on
a suspended wire or cable extending from a a suspended wire or cable extending from a a suspended wire or cable extending from a well, spring or other source of water, to the place where it is to be delivered, which may be manipulated by means of a single cord or cable for raising water, and also for transporting it.

porting it.

IBVICE FOR RETAINING FILLINGS IN
TRETIL—WILLIAM F. BARR, Post Office Box
208, Montgamery, W. Va. The invention illustrated is an improved retaining device for use
in filled teeth and has for an object to provide
a simple device to be piaced in a large tooth
cavity and to be commented in place and having



PEVICE FOR BETAINING FILLINGS IN TESTE

means which facilitate the anchoring of the retaining device in the cavity in such meaner as to secure the retaining device in place as that the ennell will operate to support a weak tooth, the securing device having papearing means for eigenpanent with the overlying metalic dilive.

BURIAL VAULT AND RECEPTACLE.

Boss, Palatin, Fig. The purpose of the system is to provide an inexpensive as

In the last in

inatish west for receiving and protecting failured in which may be adjusted in the protection of the p

. . .

EMPTCH.—F. R. WILDS, 23 The Circus, Bath, Bathand. This crutch is of the type con-cising of two tissecoping sections and a price-ing area west. The object of the inventor is need in compaction with a weaking stick, un-need in conjunction with a weaking stick, un-triding means for easthing the lower part of the crutch to be detachably connected to the walking steller, or the like which latter has its walking steller, or the like which latter has its or the control of the control of the crutch of the latter has the control of the control of the Latter has the control of the control of the Latter has the control of the control of the Latter has the control of the control of the Latter has the control of the control of the Latter has the control of the control of the Latter has the control of the control of the Latter has the control of the control of the Latter has the control of the control of the latter has the control of the control of the control of the latter has the control of the control of the control of the latter has the control of the control of the control of the latter has the control of the control of the control of the latter has the control of the control

handle constructed suitably for entrying out this investion.

It is investion.

The first and the setting tank, which City is a fair the setting tank, or other recopsises for liquids containing water with sand, tailings, or either earthy or mineral matter 1 a finely divided state. Means provide for discharging a greater quantity of heavy material advantage of considerable importance.

OIL AND SEPARATOR.—I. W. BROWN, Deed, Bakersfield, Cal. The pre-st apparatus is for use in separation of the oil from the send as fast as they are pumperfrom the oil from the send as fast as they are pumperfrom the oil from the send as fast as they are pumperfrom the oil from the send as fast as they are pumperfrom the oil from the send as fast as they are pumperfrom the oil from the send as fast as they are pumperfrom the oil from the send as fast as they are pumperfrom the oil from the send as fast as they are pumperfrom the contact with the ground or exposed where comporation can take place, or the danger of fas.

firs.

CALCULATOR.—L. D. ROBBETS, Shawano,
Wis. It is the principal object of this invention to profide a substitute for tables which
will do away with the necessity of writing
down the numbers and furnish the results in
a convenient and orderly form so that the additions can be made directly, doing away with a
large percentage of the work which is at
present done in such cases.

present tone in such reases.

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is blowing against the fire boxes on the site of the Albindaria of the Control of the Albindaria of the Control of the Albindaria of the A

NUT LOCK.—ARTHUR L. SARGEART, Attics, fadians. An object of the invention shown in the engarying is to provide a boil in which the unit is locked thereto by a wedging action of the body of the boil and by an offsetting if a portion of the thread of the boil. In deep to insure the positive locking of the unit after to insure the positive locking of the unit



NUT LOCK.

an the screw threaded portion of the bolt, the wedge portion is provided with threads so that the nut can be readily screwed into the bolt. When the wedge portion is drawn inwardly into the wedge cavity, the threads thereos will be artomatically offset from those on the body portion, so that they will positively bind the aut to form a sure lock.

tively bind the nut to form a sure lock. WHENCH.—W. J. SPOLS, New York, N. Y. Among the principal objects which the present investion has in view are: To provide in a wreach means for extending laterally the working postion of the head thereof; and to provide a construction which is simple, economical, efficient and durable. The investions particularly designed to tighten the bottom of the structural dependence wherein a handle would not have space to more.

Marion . .

regulating the supply of oil in an oil furnace proportioned to the pressure produced by the proportioned to the pressure produced by the pressure in the produce which the oil fuel is furnished, and to provide means for mancally faing the relative ratio to the elements forming the fuel. FUEL SHIPPLY CONTROLLER.—C. W. Latriessmann, Johnstown, Pe This investion relates to furnaces, heaters, bollers or other appearation in which free is borned, and has for appearation in which free is borned, and has for matically as the amount of fuel within the combustion chamber varies. The invention may be carried out in many different ways, according to the nature of the fuel employed and of the appearation in which it is burned

Household Utilities

Household Utilities.

RUPPORT FOR COOKING VESSELS.-R.

RUPPORT FOR COOKING VESSELS.-R.

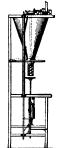
Ruswas, Winnenmera, New For the purpose of cooking use is made of a stationary ring protein with vents, a movable ring engaging the stationary ring to normally close the vents and adapted to move upwardly to open the vents, and a cover removably engaging the movable ring and adapted to hold a ng the movable ring and adapted to hold a sooking vessel thereon.

cooking vessel thereon.

VEGETABLE CUTTER—II E RAMBETER,
Duluth, Minn The Intention in this Instance
is to provide a device wherein a plurality of
cutting blades may be adjusted simultaneously
consuce the said blades to cut at any de
afred depth, and wherein the blades when adjusted may be fremly held in position

Machines and mechanical Devices,
Marking Banding and Marking A. J. Maro, New Marking Banding and the search of the

granular, pulverulent, crystalline, or other similar material, and one object is to provide for the automatic stopping of the delivering



mechanism when the package is filled to the required extent. The machine works with great accuracy and speed and cannot readily become clogged. The mechanism is compara-tively simple, so that the machine may be manufactured and sold at a comparatively low price, and cannot readily get out of proper adjustment.

adjustment. VENDINO MACHINE.—L. HORINGO, New York, N Y This invention is an improvement in reading machines, particularly such machines as are constructed for dispensing atticles of cylindrical form, such for crample, as chewing gum, candy, clear-ties and clarx, and has for its purpose to husure the proper and certain reeding of the articles into and from the freed chair to the disparing certific.

from the feed chuir to the discharging carrier TERTING MACHINE FOR PLASTIC SUB-BTANCES —II ABBAILM. Houndbrook, N. J. The object in this case is to provide a new and improved testing machine, more especially de-signed for testing plantic materials, and ar-ranged to give an accurate indication of the houndary of the control of the control of the machine.

CALCULTATION MACHINES —E. Langus, Ber-

in a wreach mass for extending laterally the footness of the machine.

In a wreach mass for extending laterally the footness position of the head thereof; and to contain the provide a construction which is simple, ecce. In the provide a construction which is simple, ecce. In the containing the simple was a simple with the containing the simple was a simple with the containing the simple was a simple with the containing operating counter members, located and have space to more.

Secular and Laghettage.

FURE. OIL REGULATOR.—E. M. Joyas, postroiled by the Orat member for the counter bearing members, locating means for preventing overpass movements of the counter bearing members, locating means, but the lociting means being extrained to the lociting member. Including means a contract the lociting member with the lociting member. Including members are contained in the lociting member with the lociting member with the lociting member. Including members are contained in the lociting member with the lociting members and the lociting members with the lociting member with the lociting members with the lociting member with the l

refers to devices for transmitting power. An object is to provide means by which motion may be transmitted from a shaft or other moving part to another shaft, with means for varying the speed or causing the reversal of the movement of the second shaft at will

Ballways and Their Accessories.

LANOMOTIVE VALVE—C. W MANYDOCK,
PRISERRIA, G. The Improvement is in fred
valves for cylinders and designed for use on
leasemants explinders. It provides a rocking
valve in cylindreal form, which can be oscillated from any suitable moving part of the
lated from any suitable moving part of the
other control of the cylinder and to
correspondingly chanast the steam as the opperstion proceede.

AUDOMATIC COUPLING FOR SIGNAL,
AIR, AND STRAM BRTWEEN CARS.—P. B
SIREMON, MOVE INVESTIGATION, THE INVESTIGATION
With hipe sections extending loosely through
II, each coupling head being further provided
with apring mechanism for holding the respetive pipes in predetermined normal positions,
so as to allow them to yield relatively to the
coupling. Care the providers of the coupling
CAR DOOR HANGER —C. F. REGULJuniata, B. The inventop roorders an outsideslipping door adapted to be disposed than with
the outside of the war body, provides a countdownwhereby the sax may be taken up, provides a means for lacking the door in provides
means for disposing the door in locked position to ventiles the care; is not provided to the
mounting of the door whereby the interfermounting of the

Pertaining to Recreation.
AUDISMENT APPARATUR—W F Maxvirus, New York, N Y The object of this invertion, which relates to carosues, is to provide an amuscinent apparatus, nurse especially
designed for use in pleasure resents, parks,
etc., and arranged to accommodate a large
number of persons at one time and to provide
an exhibitanting ride, part of the motion being
produced by the occupant to sail their onvenience

convenience

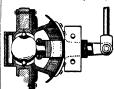
PINII HOOK.—HENRY D BALCOM, Belfart,
N Y Mr Balcom's invention relates to fish
hooks, and it has for its object to provide
a fish hook having a divided shank, the memiers of which are roughened on their innersides for gripping the dorsal fin of a minnow



a ring helug mounted on the shank, and adapted to be moved along the same for pressing the numbers against the said dorsai fin, as shown in the illustration. As the minnow is not cut of or brouled in any way, it may be used for a long period, avoiding the necessity of removing the best from time to time.

Pertaining to Vehicles.

DRIVING AND STEERING DEVICE FOR VEHICLES -- Edward A. Gottern, Box 1,154 Bishee, Ariz in the present patent the in-vention illustrated has for its object the pro-



VEHICLE DRIVING AND STARTING DEVICE

vision of a new and improved driving and steering derice for automobiles, marine ve-sics and other whites, and arranged to per-sist and other whites, and arranged to per-turning the same into any angular position for use for steering purposes, the derice being simple and durable in construction, enally manupulated, and arranged to defectively tran-nit the power and to reduce the friction to the properties of the per-turning the same power and the power and to the pro-terior to the per-turning the properties of the per-turning the properties of the per-turning the properties of the per-turning the per-perturning the per-perturning the per-turning the per-turning the per-perturning th

B BRINDER.

DETACTIBLE WHEEL BIM.—A. D. FOUCARF, Moncy, Pa. This insreution is an improvement particularly on those which are increased by the Scherrick Assects for provided with pneumatic or solid rubber tires!

Description of the Invention, and date of this paper.

commonly used on automobiles, traction en-gines, and bicycles. By this improvement one is enabled to detach the rubber tire or outer portion together with the part to which it is attached, and to substitute a similar one in a few seconds.

WHEEL.-JOSEPH L SPOONTS and EDWIN M ECHANE, Ballinger, Texas The invention hown in the accompanying illustration has



for Its object to provide a wheel having a preumatic tire, but wherein the tire will be so placed that it! will not contract with the ground, thus reducing the wear to a minimum, illured by the whoel consists of an inner and an outer wheel, the said wheels being movable-raddily and anguistry with respect to each other, and yielding means for retaining them in normal position. The wheel might also be in normal position. The wheels and capable of the short of the short means the property of the short of the short means of the short of the short

ROLLER BEARING — I Rators, N Johns, Ore This invention contemplate an authriction bearing capable of free working under and thrust in either direction, or a latest strain, as that occasioned by the weight of the load, the bearing consisting of an huner and outer bearing member and an internally threaded bearing amounted in the more bearing threaded bearing appearance of the property of the prope

nearing support from the opposite suices thereof ENGINE STARTING DEVICE—LADTO B HALLOCK and GOROOR T KERN, New York, N Y Address George T Keen, Hotel Mar-thique, Broadway and 32nd Street, New York city. The object of the invention shown in the engraving is to provide a device more espe-cially designed for use on internal combustion



ENGINE-STARTING DEVICE

engines employed in automobiles, motor beats and other power driven vehicles, and arranged to enable the operator in charge to conveal entity reach the device and to actuate the same for turning the engine shaft without much physical exertion or leaving the seat. For this purpose use is made of a growed shaft and provided with a sieve for turning the shart in one direction are recovered.

in one direction to rotate the engine shaft

VEHICLE WHEEL. W. I Howam. Twenty

Ton, N. J. This invention relate to evolution

ton, N. J. This invention relate to evolution

ton the first product of the same property of the desirability accurate the same protect principle at the wheel desiched in two prior parients formerly granted to him, but involves certain improvements in the cause and the means for mountin, operating and controlling vertain the province of the type in which the three is carried by a removable rim, so that in case of a puncture or other injury to the tire, the injured tire and the rim may be readily removed and replaced by a new rim carrying a previously inflated tire.

Nows—Coules of any of these patence will

NEW BOOKS, RTC.

THE CONSTRUCTION OF A HOUSE. By Charles Gourlay, B.Sc. New York: John Lane Company, 1910. 4to.; 40 plates. Price, \$2.75 net, postage 25 cents extra.

plates. Price, \$2.75 net, postage \$5 centle setts.

The drawings which make up most of the volume slow in plan, elevation, and detail an English country boses standing in its own and the state of the state building are of stone, those of the billiard room of stone with birth kneight, thi things materials, the outer walls of the state boses of finished brickwork, and the chauffeur's ledge of his with stone dressings for the lower a ry and half-disher work for the upper. The state is Rousiance conservation to the state of the state of

E SUGAR By Noel Deerr Altrincham (Manchester) England Norman Rodger, 1911 8vo; 592 pp.; illustrated Price, \$8 net. CANE SUGAR

man Rodger, 1911. 8vo; 592 pp.; th-lustrated Price, 48 net of the Price, 48 net.

A fine volume, carring the reader through every phase of one culture and sugar manu-facture. The cultivated species is described behaviorally one of the street is explained, and the structure of the strick is explained, and the structure of the strick is explained, and the function of the loaf as the "wager manufac-tory" of the plant is clearly shown. The com-position of the came, which depends largely upon the variety and conditions of growth, is approximately street. The range and climate are formed to the strick of a long clospfor. Pull-page illustrations in color depict the Bourison the Rose, the Purple, and the Striped Tanna; and the delirate great sheighter shown, the Wilder, the Black, and the Striped Tanna; and the delirate great sheighter sheighter of the street of the striped results of a long clospfor. Striped Ramon, the Wilder, the Black, and the Striped Tanna; and the delirate great striped results by the striped of the manufac-ture occups succeeding chapters, and the pears and theses to which it is subject are dealt with in detail. The mechanical part of sugar production follows—the extraction of the interior under the different processes are plentiful. Molasses is given a chap-ter to itself and other chapters follow on the factory. Important tailed form an ap-pendix to a notworthy volume. pendix to a noteworthy volume

THE AMERICAN ANNUAL OF PHOTOGRAPHY
1911 New York. George Murphy,
Inc. 8vo., 328 pp. Price, paper, 75
cents; cloth, \$1.25.

Inc. NO., 323 BP. Price, paper, inrestrict (10th, \$12.50. of the American
Annual recentry-fifth volume and the two hundred illustrations make up an
lease of the art, and its articles and
the two hundred illustrations make up an
lease of high merit. There are hirly two
plates in color. With one or two exceptions
cuttons were are generally settlefactory. The
articles are based upon such a wide variety
of sublects that only a very few can be mentioned here. "Photography at Night," "Marecording the articles are based upon such a wide variety
of sublects that only a very few can be mentioned here. "Photography at Night," "Mastage, "tire-channess Photography," and "Phoeer Portraitis" frost of special subjects and
their handling. "Steroscopt," Debtography
Simplified." "Implicating Lanters Miles,"
methods and processor. Among other papers
worth noting are. The Tele-Photo Lens and
the Hand-Course," "Photography."
Norges on Simonarro, "Photography."
Norges on Simonarro, "Photography."
Norges on Simonarro, "Photography."

Notes on Innoation Works. By N F.
Mackenzie. New York. D Van
Nostrand Company, 1910 8vo , 111
pp. Price, \$2.50

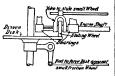
pp rrice, \$2.00 The writer was lately Under-Secretary for frigation to the Government of India, and there notes are a series of lectures delivered at Oxford in 1900 As comparatively few of the problems in engineering and communities may be presented within the time of a half-down lectures, the discussion is confined to, first, a general idea of Irrigation works and their results, with the situation requires the order of the problems. their results, with the statistics required for in frigation project, types of weirs are then considered, with the principles on which their yign is least; the development of Egyp-irrigation, the design of irrigation chan-and irrigation and land revenue in in-termediate the volume.

ir is hased; to irrigation, the and irrigation who the subject of conclude i



Kindly keep your ourries on separate sheets of paper when corresponding about such materia as patents, underlyinden, books, etc. This will greatly facilitate answering your quastrated to be a separate of the second of the second to separate the second to separate the second to separate the second to separate the second to see the second to seco

(12458) I. N. S. asks: Please explain (13468) I. N. S. asks: Please explain the principle of friction drive and transmission as applied to automobiles in comparison to the shart drive and gears. A. To permit of varying the number of revolutions made by of the automobile, several sets of garding of different ratios are introduced between en-gine and axis. By suitable berres, any de-sired pair of gears may be slid endwise into mesh, while the other sets are at the same meshing pair determines the relative speed of



wheel and oughe. The friction-drive car accomplishes the same result by running together two smooth whose, which having no tech, which have the same and the same an

(12469) A. J. G. says. I wish you to explain an optical lituden that we see here every day. I live in a yard inclosed with a covery day. I live in a yard inclosed with a form the force which is on the sidewalk Whenever an automobile passes, the wheels as viewed linough the force seem to be moving landward, and that part of them to be moving landward, and that part of them to be moving landward, and that part of them to be moving landward, and that part of them to be partied at the special section of the wheel with the control of the section of the section of the whole white through the palings by intermitted lights are without the section of the wheel white distribution of the wheel is moving along while the top moves forward and the bottom moves backward with reference to the said. Whether the wavel with the section of the wheel shall seem to turn backward out forward whether the whole the whole the whole the wavel white the work of the wavel with the whole the whole the wavel white the wavel with the parties of the wavel white the wavel white the wavel white the wavel white wavel white the wavel was the wavel wavel to be water to be a ward of the wavel wavel to be water to (12459) A. J. G. says. I wish you to

were in the projection of moving vehicles that the the moving picture machines.

(12460) J. S. C. writes: In reference to query No. 12547 in Scientrica Australia, Au

by Fire

(Construed Pros page 581).

tively small, and can be recovered after
the record has been transcribed, by terriing the carbon and collecting the ash.
The opening of folded documents required the cutting at each fold, and the
various sections were floated and assembled carefully, to be treated as intact

A small proportion of partially charred matter came up for restoration. The presented some most startling phase ena. Part of the writing would appear as clear as fresh writing on paper like color, and some of the writing on the same page would be invisible. This appeared when the paper had only been scorched to a color no darker than ordi-

Peroxide of hydrogen succeeded with all that we treated, but presumably meth-ods known to succeed for faded papers

ods known to succeed for muon passess would be as good or better. Under this class of records 1 had presented some impression sheets from manifold books, the impression having been made with aniline transfer paper. They were carbonized to a seal brown. I finally obtained these records by floating face down on a bath made alkaline with sodown on a bath made alkaline with so-dium blearbonate and reading the re-versed writing that appeared through the paper by means of looking glasses. No results could be obtained by treatment on the face side

The following should be known by

users of safes:

users or sares:

Documents should not be folded. Papers or currency should never be kept with coin, jewelry, etc. Many papers and large coin, jeweiry, etc. Meny papers and large amounts of currency were broken to pieces in removing safes from ruins. Never place important papers or currency in wallets, or use rubber hands. These are melted and coment the concents, making it difficult to separate. Don't dedde that currency or documents are destroyed by being broken Large sums were lost through this mistaken notion. It was surprising what success was obtained in plecing together small fragments of currency, etc. Many thousands of dollars were redeemed by the government, at small cost, where the various parts had been preserved, and many thousands lost needlessly.

The Variable Speed Aeroplane

(Continued from page 683.)
arched sustaining surfaces x are capable of rotation on transverse horizontal axes Y. M is the motor, R the fuel tank and C the chaufteur's seat, and L a lever by which the chauffeur can control the in clination of the propeller blades if their automatic regulation becomes deranged S is the seat of the pilot, who operates the rudders and also varies the inclina the rudders and also varies the inclina-tion of the austaining surfaces by turning the wheel T. The mean inclination of these surfaces to the horizon, as they

the wheel T. The mean inclination of these surfaces to the horizon, as they are drawn in the figure, is about 15 departs of the defect of the departs of the defect of the surfaces is about 7 degrees, and the aero-piane has attained its normal speed. In landing the inclination of the surfaces is gradually increased to 15 degrees, while gradually interessed to its engineer, when the power is diminished, and just before the ground is struck the ignition is cut off and the inclination of the sustaining surfaces is suddenly increased to its maximum value of about 30 degrees.

The Current Supplement

A MONG the more interesting articles Athat appear in the current Surrusment, No. 1847, we may mention an excellent speculation by J. Löwy on the mature of invention.—The Servicement of



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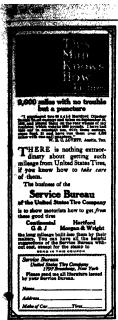
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radioactive investigations in recent years, and especially the increasing employment of radium and its emanation in medicine, and especially the lacessading employment of radium and its emandion in medicine, has created a strong demand for radium-contres substances, which cannot be satisfied by radium itself. As a substitute for radium, the slowly disintegrating derivatives of thorium, which are known as mesothorium and radichorium, suggest themselves. In order to understand the possibility of that substitution, as mesothorium of the substitution of the possibility of the substitution of understand. The possibility of the substitution of our ratigues are described and illustrated—Within the last few years some of our ratificed, industrial, and steambly companies have begun to realize the important part that mechanical transference plays in the quick and economical handling of material Mr. Alchord Devenous handling of material for the mechanical Handling of Materials "An anvel type of gas machine is described and illustrated—A. F. Bock tells how houses are moved in Germany—A new engine has been introduced to take the place of the older steam-driven blowing engine. This is the substitution of the home are published—Mr. A. H. Godard writes on the bee as an architect—Mr. Sacuberlich continues his excellent paper on Diesel marine engines.—The discourse delivered by Prof. William H. Brage, of on Diesel marine engines.—The discourse delivered by Prof. William H. Bragg, of the Royal Institution, on "Radioactivity as a Kinetic Theory of a Fourth State of Matter," is published.

Accidents to Dirigibles and Their Lessons

By Carl Dienstbach

By Carl Diesathach
W JTHIN a few days of one another,
W JTHIN a few days of one another,
Zeppelin's latest aerial leviathan), a
Parseval strabily, and the English army
dirigible have all come to grief Two
years ago, these dissaters would probyears ago, these dissaters would proboment of a type of craft whose possibilities are little understood in this
country. As it is, a few timild stockbilities are little understood in this country. As it is, a few timid stockholders in the companies which have done so much to exploit the dirigible in Germany may lose heart; but on the whole, the performances of the giant dirigible have shown that the type has commercial future, and that it has come to stay. How promising is the development of a bandly law them, more already emphasized than by the Parseway. Company's decision to increase its val company's decision to increase its capital considerably, and to begin the construction of a newer and bigger passenger ship, and a newer and larger shed in which to house it—all for the Berlin

reager snip, and a newer and larger shed in which to house it—all for the Berlin service.

The wrecking of one of Count von Zeppelin's giant dirigibles one after the other has no doubt called forth comments of approval; for only too often has the big dirigible shee nonfemmed be the state of the dirigible sheet normal services of the dirigible and the ground has not yet been satisfactority slowed. Critica of the dirigible are apt to forget that before Bierlot successed in producing his model No. 10, with which successful flights were first accomplished in a monoplane, machine after machine had come to grief What is more, they also forget that in these days of the parfected Bierlot, when monoplance by the score filt through the Air.

all more, they also to next the more planes by the prefetch differences the next planes by the machines are weeked than at any other time in the bistory of sorial navigation. Does that mean that Louis Bleiret and other builders of dying machines will cease to manufacture? Even though the urged that the monetary loss involved in the wrecking of a Zeppelin is supendous, it will probably be no difficult matter to prove that the financial loss involved in the wrecking of hundreds of monoplanes and biplanes is not much less than that involved in the loss of all the Zeppelins up to date. Surely, the dirigible has sarned an undeserved, reputation because its wrecks are spectacular, and because the loss is spectacular, and because the loss is concentrated.

concentrated.

The latest Zeppelin wreek is instructive. It emphasises the fact that alciton though the dirigible has been so far perlecopt that it is able to nextgate the sir
specify and safely, there is still no
adequate method of handling and docking
it. The first injury that beful the



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"Parseval VI.," after six months of suc-cessful continuous service, was incurred not in the air, but on the ground.

not in the air, but on the ground.

The failure to provide decking machinery and the tendency to rely entirely upon muscular power are easily explained. The first dirigibles were small, so small that a few men could handle them with comparative ease. When it was found that the increase in size meant the two that the therease in size meant increase in file fletancy, and when, accordingly, the sinhip began to grow, no effort was made to improve upon the primitive methods of docking, although time and time again they have proven themselves inadequate. It was pointed out in these columns that an airnhip should be moored to an anchoring tower, around which it can awing with the wind, as unhampered as a weather vane, and from which it could drift away when starting, and to which it could be moored sagain by dropping a rope from above. from which it could drift away when starting, and to which it could be moored again by dropping a rope from above. But so long as airships are compelled to enter a long shed, which is nothing more or less than an elongsate dog kennel, the problem will be difficult to solve if we immat adners to the shed, why is it not possible to liny a subtervanean track along time of the contraction of th and settle down easily it an airsnip is to land safely, it must land at some dis-tance from its shed, so that the possi-bility of the wind's pounding it against a large wooden wall or roof is avoided

What happened to the "Deutschland" would happen to the "Lusitania" if she would happen to the bastania. It she had to moor in a space not much wider than her hull between two walls that ended in the surf of a rocky shore. The sides of an alrship shed are as dangerous to a "Deutschland" as the cliffs of a rocky coast. Compared with the enter-ing of a shed in the wind, an enforced landing in the open is safe.

The truth of these statements is borne The truth of these statements is borns out by the peculiar accident that happened to the military Parseval of the fortress of Cologne. Some time ago, that vessel was shipped to Bitterfeld to be overhauled. After the overhauling was overhauled. After the overhauling of coverhauled after the overhauling overhauled overhauling overhauled when the coverhauling of the coverhauling over the coverhauling over the coverhauling over the coverhauling over the coverhauling overhauling although but alightly

Highest Barometric Pressure Ever Ob-served in Europe.—Meteorological reports from European Russia show that an anti-cyclone of unprecedented intensity pre-valled over the eastern portion of that country on November 28th and 27th, valled over the eastern portion of same country on November 28th and 27th, 1910. At several stations the barometric pressure (reduced to sea level and stand-ard gravity) exceeded 800 millimeters ard gravity) exceeded 800 millimeters (33,50 inches), thus breaking the European record established by the remarkably high pressure of January, 1907, in the same region At Katharinenburg, at 7 A M. November 28th, the harmseter (corrected and reduced as stated above) read 800.7 millimeters (3,1524 inches), the highest pressure ever recorded at a European station. The anticyclose was accompanied by destructive wind storms over the Biaco, Casplan and Appt cease.



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A Beginner Killed at Los Angeles A Beginner Killed at Lee Angelea.—
An unusual serojiana accident occurred
at Lee Angeles on May 17th, as a result
of which A. V. Hardle of Marcellies, O.,
iost his lite. Hardle was a beginner
who had made his first flight in a biplane
only the day before. He was warned by
als instructor not to be so hasty, but
he persisted in trying to make a big
as a servent in the literature of the servent in the literature of the litera

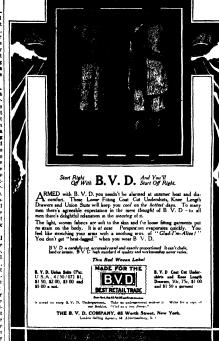
a result he fell from a considerable height and was instantly killed.

A Deable Accoplane Fatality in France.—On May 18th, at Rheims, France, a monoplane driven by Pierre Marie Bournique, the R. B. P. pilot who made some accellent speed and distance records at we published in our recent Aviation Number, plunged to the ground from a height of some 200 feet, instantly killing Lieut. Paul Dupuis, the passenger, and so badly injuring the aviator that he died soon after the accident. That the machine struck the ground seems to be a second of the second seems of the second second seems of the second seems nt wrong with the controls

went wrong with the controls.

The Cause of Lieut, Kelly's Fatal
Aeroplane Accident.—That Lieut, George
E. Kelly lost his life at San Antonio,
Tex., on May 10th, in an attempt to avoid
failing upon the soldiers there encamped, Tex., on May 16th, in an attempt to avoid failing upon the soldiers there encamped, is brought out by the army board that did not be the soldiers there is a soldier to the soldiers there is a soldier of the soldiers. No Board that didded of First Lieut. P. N. Board That Lieut. B. D. Foulois and Second Lieut John. C. Waller, Jr., as follows: "After striking the ground the first time the machine bounded to a height of approximately 10 feet, gradually rising to about 30 feet, until within 75 yards of the camp of the Eleventh Infantry. It made a sharp turn to the left and made an abrupt dive to the ground. Lieut. Kelly distance of about 20 feet. As a result of the first impact with the earth it is apparent that the pilot lost control of the front elevator control. From all these preceding facts the board is of the unanimous opinion that the accident was due to the "efforts of Lieut. Kelly to avoid endangering the occupants of the Eleventh Infantry camp, in which endeavor eath infantry camp, in which endeavor endangering the occupants of the Eleventh Infantry camp, in which endeavor it became necessary for him to make a sharp left turn which, in the crippled condition of the machine, brought more strain on the controls than would have been required in a straightaway landing. Such straightaway landing was impracticable, owing to the proximity of the tents.

Accident to "Deutschland II." and Other Airships.—The dirigibles have latterly been having about as many acci-dents as the seroplanes. When the Other Airships.—The dirigibles have latterly been having about as many actions as the zeroplanes. When the number of airships in use is compared with the number of airships in use is compared with the number of aeroplanes, the actions to the former are out of all properties to the passagers and crew generally come out unceathed. The latest and largest airship to come to grief is the large Zeppelin 'Deutschland II.' Just as she was aimost out of her shed at Dieseldorf on the 16th instant, a heavy just of wind banged her back against it, fore off the outer envelope, and burst a couple of the twenty-odd of the compared to the compare doubtful whether it will ever be repaired. In addition to this, the new 510-toot English naval airahlp No. 1 met with an accident while being assembled; and on May 17th the Parseval II. was blown against her shed at Historteid and wrocked at the end of a tital trip. This accident was an exception front the fact that two passengars suffered sprained that two passengars suffered sprained.





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Latest Type of Scout Cruisers.—The latest type of scout cruiser of the British navy, the "Dartmouth," is of 5,356 tons, carries eight 6-inch guns, and will prob-ably have a speed of 36 to 37 knots. The scouts, like every other type of warship, are increasing rapidly in size.

Seamless Tubes from Pierced Billets.

In making seamless tubes from pierced, round steel billets, the latter are heated, cut into lengths of 22 to 85 inches, recut into lengths of 22 to 85 inches, re-heated and pierced by soft iron plugs, and roughed down into tubes 8 to 11 feet long, all in one heat. After reheating, the tubes are rolled in the finishing mill into tubes from 11 to 14 feet long.

into tubes from 11 to 14 feet long.

Great Britain's laval Program.—The
naval estimates for Great Britain call for
a total expenditure of \$2,000,000 for
the year 1911 to 1912 There is to be a
total increase of \$2,246 men, \$5 commissloned officers, and 149 warrant officers.
Five large armored ships are to be built,
three protected cruisers, one unarmored
cruiser, twenty destroyers, aix submarines, and a few amailer craft.

Steamship Salved by Compressed Air.

—Another steamship has been raised by
the Arbuckle compressed air method,
which has been described in the Scien-TIPIC AMERICAN. This time the vessel was the "Soperga," an Italian ship which went ashore on Molasses Reef on her way from New York to Galveston. The apparatus was applied April 29th, and on May 6th the vessel was afloat.

Scientific Management at Navy Yards.

—H. L. Gantt, Harrington Emerson and Charles Day, experts in scientific management, have visited the principal Eastagement, have visited the principal East-ern navy yards, at the request of Sec-retary Meyer, for the purpose of giving suggestions for improving the manage-ment of manufacturing and repair shops along the lines which have given such good results in railroad and industrial satablishment. establishments.

Barge Canal Terminals.—A conference of commercial bodies throughout the State of New York Interested in the Barge Canal has agreed upon a plan for terminals, which will cost \$18,600,000 to carry out. The bill provides that any city or village along the canal may petition for terminal facilities, which petition will be passed upon by the State Superintendent. About 100 representa-tives from points contiguous to the canal were present at the conference

Fictitious Danger in Oiled Roads.— The city officials of South Norwalk are stated to be about to stop the system of oiling the roads; this decision being based on a recent trolley accident, which was said to be due to the greasy condition of the rails as the result of road oiling. In view of the great benefits deoiling In view of the great benefits de-rived from the system, we think that a decision to abandon it should be based on more extended evidence than was at the disposal of the South Norwalk officials.

Date of Panama Canal Completion.— As the depth of the Culebra cut at Pan-ama increases and its width narrows, the number of shovels that can be employed, number of shovels that can be employed, and therefore the total output per month, will decrease Allowing however for this, it is evident that the great cut will be completed by January 1st, 1913. At Gatun the concreting of the upper locks is 55 per cent completed; 50 per cent has been laid in the middle locks, and the greater part of the floor of the lower lock has been covered with concrets. Olck has been covered with concrets. The control of the lower lock has been covered with concrets. The control of the lower lock has been covered with concrets. The control of the lower lock has been covered with concrets. The control of the lower lock has been covered with concrets.

New Electric Militiany Ministra. Apparatus for militing cores by means of a partial vacuum have been used for a number of years. In a new form of militing machine just invented by a Swedish engineer, pressure instead of suntion is employed, so that the act of militing is similar to that of the hand operation. The device consists of a set of rubber-covered plates which are made to press the tests by means of suitable mechanism driven by a small electric motor. The current required to drive the machine is less than half an ampere New Electric Military Mar paratus for milking cows by

Award of the Edison Medal.—The Edison Gold Medal, which is awarded annually to residents of the United States and Canada 'for meritorious achievement in electrical science, electrical engineering, or electrical earls, bas been granted the year to Frank Julian Sprague, the well-known inventor of the multiple-unit well-known inventor of the multiple-unit control system in electrical transporta-tion. The model was awarded at the annual meeting of the American Insti-tute of Electrical Engineers. This is the second modal given by the Institute. The first one was presented last year to Prof. Ellhu Thomson.

Pastecting Tungsten Street Lamps.

The City Lighting Company of Lawrence
ville, Ill., has recently experienced trouble with its series-connected tungster yille, Ill., has recently experienced trouble with its series-connected ungated attreet lamps, owing to the breaking of filaments on windy days. To overcome this difficulty, the company is now supplying the lamps during the dayding the lamps during the dayding the lamps during the dayding the lamps during the filaments ductile is employed only on windy days. The same system is in use on railroad lighting systems, where the lamps must necessarily be subjected to a great deal of jarring. In the case of the Lawrenceville street lamps, it was decided to employ this method of protecting the filaments, largely for the reason that in case of the failure of a single lamp all the rest of the series would be put out of commission, which condition would not be discovered until night-time, when the lighting current was turned on. turned on.

Roston-Washington Telephone Conduit.

—In order to avoid the repetition of such a disaster as occurred to the telephone and telegraph lines about Washington at the time of President Taft's inaugion at the time of President Tat's Inaururation, an underground cable route has been under conservation, which when completed will connect Washington with Boston. About half of the line running from Boston to New York is completed. The section between New York and Philadelphia has been in service for some time, and that between Washington and Wilmington was built last fall. This cables will contain 7d pairs of copper wires, and by plantening it and the wires, and by plantening it composed with the section of the section of the section between Philadelphia and Washington there will be nearly 10,000 Pupin coils. The ditch for the cable has been dug largely by means of trench rupin cois. The ditch for the came has been dug largely by means of trench machines. At frequent intervals manholes are provided, built of concrete slabs with concrete covers.

55 per cent completed; 50 per cent has been laid in the middle locks, and the present has been locks and the great control of the Electrical World contains a study artificial daylight by Mesers. H. E. the should also be finished by January 1st, 1913

Electric versus Steam Locometres.—
These locks and the great Gatun dam should also be finished by January 1st, 1913

Electric versus Steam Locometres.—
The chlor electrical ongineer of the New Proper on the electrical operation of the system, and the control paper on the electrical operation of delars in the service due to electrical operation at the service due to electrical operation stated that eighteen months after commercial service was inaugurated, the calculation of over 15,700 miles per engine yallo inches. The bottom of the box comference of the state of the glasses, one coasted with 22rd, 1800, 66,000 electric locometry in the service was limited the state of two glasses, one coasted with 22rd, 1800, 66,000 electric locometry in the glasties film, and the other being mice were run (about equal to eleven) round trips from New York to fau Pran-Taling awe an illumination of about 300 inches. The bottom of the box control of the service was a liftuary to the properties of day-service was a fifteer, college of the properties of the prop

Artificial Daylight.—A recent number of the Electrical World contains a study





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Science
Remarkable Journey of a Toy Balloce.

—A correspondent of Cosmos describes the remarkable journey performed by a paper balloon, such as may be obtained from the toy shops, which he sent up, with a postal card attached, on Sunday, February 30th, at Tourcoing (Nord). Two days later the card was returned from Cornimont (Voages), 475 kilometers (268 miles) distant, with a note indicating that the journey to the latter point had been accomplished in 2 hours and 46 minutes; i e., at the rate of about 94 miles an hour A northwest gale was blowing at the time

A New Meteorological Bervice in Africa.—The Belgian government is endeavoring to exploit on scientific principles its vast African colony, Belgian Conno. From the Bulletin Agricole du Conno. Belgian control and the State of the Climate of this territory is study of the Climate of this territory is study of the Climate of this territory is preliminary to its industrial and serious curval development. The country has been preliminary to its industrial and agricul-tural development. The country has been divided into sections two degrees square, in each of which at least one meteorologistation will be established cal station will be established. The réseau will include two or three stations of the first order, where all classes of meteorological observations will be made meteorological observations will be made Such a station has been maintained at Banana, near the mouth of the Congo River, for some fifteen years, but the greater part of the Congo territory is un-

The Climate of South Africa.—The Quarterly Journal of the Royal Meteoratogical Society for January publishes an Interesting description of the climate of Interesting description of the climate of Interesting the Interesting the Interesting the Interesting the Interesting the Interest of the Transaction, In apite of the large extent of territory embraced within the Union, its climate is remarkably even, and is in the fullost sense a temperate one The average rainfall for the whole of the Union is about 33 inches, but the northwestern part is practically rainless. Abundance of sunshine is, on the whole, the most striking characteristic feature of the country. The climate may be briefly described as genial, exhibarating, sunny and dusty, though intense dust-torms are in-The Climate of South Africa. -The scribed as genial, exhibitating, sunny and dusty, though intense dust-storms are infrequent. Snow is not uncommon in Basutoland and parts of Cape Colony, but is rare in the Transvaal The Orange River and Transvaal provinces suffer from destructive hallstorms.

Intensive Climatography.—This term may be applied to a class of scientific literature that is popular in Europe but may be applied to a class of scientific literature that is popular in Europe but almost unknown on this side of the Atlantic Students at the European universities not infrequently choose as the subject of their academic theses the climate of some particular town or other small geographic unit, and discuss the whole available body of meteorological Observations in manufacture of the subject of the whole available body of meteorological observations in manufacture of the subject of t universities who are casting about for virgin fields of investigation. There are many places in the United States at which meteorological observations have which meteorological observations have been made regularly for a long enough period to serve as the basis of a similar discussion; in some cases they extend hack over a century or more. Yet Dr. Fassig's work on the climate of Balti-more, published a few years ago by the Maryland Weather Service, is the unique example of the treatment of the meteorexample of the treatment of the mercor-ology of an American city on a scale comparable to that of the numerous works pertaining to places abroad. Such discussions possess more than a theoreti-cal interest; the establishment of the cal interest; the establishment of the normal climatic statistics of a particular place is a matter that congerns the municipal engineer, the hygienist, the architect, the electrician engaged in light and power production, etc.

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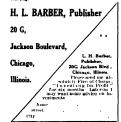
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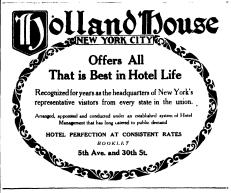
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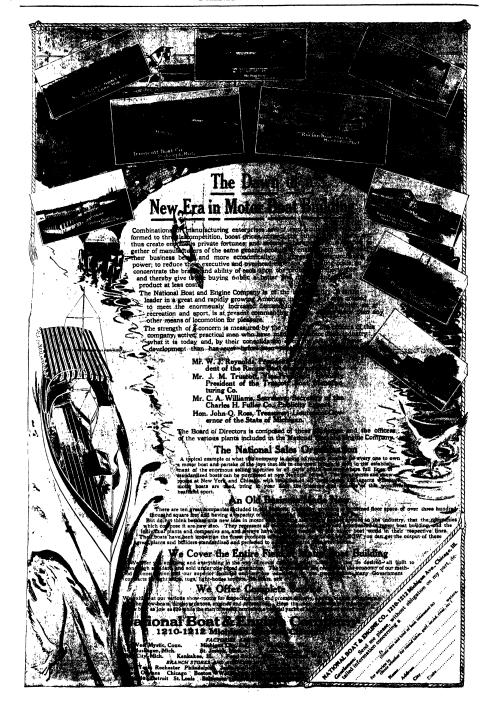
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THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

OLUME CIV.

NEW YORK, JUNE 3, 1911

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ON THE "FIRING LINE" ABOARD THE "NORTH DAKOTA."-[See page 544.]

SCIENTIFIC AMERICAN

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The falter is always giad to receive for examination allustrated in to be on submets of timely interest. If the photographs are story, the articles short and the first authority, the contributions will receive succini attention. Accepted attacles will be paid for at regular state (10)s.

The purpose of this journal is to record accurately and in simple terms, the world's progress in securitie knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fuscination of science

The Demand for a Better Parcels Post

YOW that the Rural Free Delivery Service and the Postal Savings Banks, the two new features which have been added to the business of the Post Office within the past few years, o successful and convenient, it is time measures be adopted to improve the existing limited parcels post. This can best be done by lowering the rates and extending the weight limit, in order that they may conform, in some measure, to the present world's Postal Union standards

At a conference of the Postal Progress League in this city on May 24th last it was proposed and recommended that the postal rate for parcels be reduced from sixteen cents to eight cents a pound, and that the limit of weight for a single parcel be inreased from four to eleven pounds, that all mall matter be insured, and that a still lower rate b established for the carriage of parcels on the Rural Service Routes.

These features, it was stated, were included in bill known as the Sulzer bill, introduced at the present session of Congress by the Hon. William Sulzer of New York, which has been referred to the House Committee on the Post Office and Post Roads This committee has appointed June 14th next, at Washington, D. C., as a day for a public hearing on the subject. Every one interested should address a letter to the chairman of that committee.

When it is understood that one of our largest express companies is carrying parcels post packages from Great Britain and delivering them to any part of the United States at the rate of about two and one half cents a pound, it will be safe to assume that the rate of eight cents a pound as suggested in the Sulzer bill, is a conservative one.

The benefits of an extended parcels post can hardly be measured in words. It will enable the producer to trade directly with the consumer on an basis, since merchandise and distributed everywhere, regardless of the dis-tance, at one, single uniform rate. We believe the time is close at hand when favorable action by Congress can be expected

Scientific Management on Sea and Shore

N an age when dissatisfaction with many of the Government departments is all too rife, it is refreshing to realize that there are certain of them to which the nation can turn with genuine satisfac-tion. Prominent among the latter is the United States navy, which, as represented by the noble fleet of vessels now in commission, is regarded with confidence and pride by the people of this country.

We doubt if the navy has ever received a com-

pliment which gave greater satisfaction, from the Secretary down to the youngest calisted man, than that bestowed by the scientific management experts who have recently been cruising with the flect for the purpose of determining how far it could be bettered by the application of the principles for which they stand.

Referring to this matter in his recent speech be-fore the Economic Club of the City of New York,

Secretary of the Navy G. v. L. Meyer called attention to what has been accomplished on the battleship through practice of scientific management, which, although not known by this name, has been which atthough not known of uns hance, and has followed in the fleet for many years, and has brought about a wonderful increase in efficiency, particularly in the matter of gunnery. The experts on scientific management, during their cruise with the fleet, witnessed the whole of the operations involved in carrying out a "battle practice," and on their return they reported to the Secretary that the battleship was the finest exhibition of scientific management they had ever seen. The methods by which the present conditions have been brought about are exactly those which form the fundamental principles of scientific shop management. This involves a systematic study of the men and their qualifications, and the recognition of the necessity of placing men, after a careful test, in positions in which they can do their best work. Team work has been encouraged, and where, in the industrial world, it is a question of the saving of hours, in the navy the saving of minutes, and even seconds. has not been overlooked in the effort to secure the greatest number of hits per gun per minute.

From the sea the Secretary then turned his at-tention to the shore, and he deplored the fact that although in the effort to concentrate may yard work he had recommended the abolition of certain scattered and practically useless navy yards, thereby saving an annual maintenance expense of \$1.600; not a single navy yard had as yet been abolished by Congress.

The navy yards are a constant and unnecessary drain upon the resources of the navy. Certain first class and strategically well located yards, such as those at New York, Boston, Philadelphia and Norfolk, are, of course, a necessity, but the number of yards on the Atlantic coast and the Gulf of Mexico is excessive and in many cases they are not well placed. This condition of things has been brought about in some varies by the desire on the part of Congressmen to have navy yards located in their States, while other yards, which were established in colonial days, have been built up unnecessarily, the individual member being ambitious to see the vard in his State at least equal in importance to those in other States, and failing to take into consideration its value from a military and economic point of view As a result, we have on the Atlantic Coast muc many yards, on which in some instances money has been expended lavishly. This would not have happened if the strategic and economic point of view only had been considered.

Surely the reasons advanced for getting rid of these obsolete stations, with their "needless drain upon the Government's financial resources," are sufficiently cogent to satisfy any member of Congress who has the national interests sincerely at art. New Orleans, we are told, is badly located Its position, 100 miles up the river, is such that in time of war, or threatened war, no large vessels of war, or threatened war, no large vessels should be sent there on account of the danger of shound be sent there on account of the daily of the passes being blocked. Florida now has two navy yards, and by the abolishment of Pensacola there would still be left one yard, Key West, in an there would still be let one yard. Acy West, in an advantageous position. South Carolina has two yards, Port Royal and Charleston. The yard at Port Royal is absolutely useless. It has a dock, built at a cost of about \$500,000, which cannot be approached by a battleship. Sacketts Harbor is located on Luke Ontario. New London is nothing more than a coaling station back of the New York. New Haven and Hartford Railroad bridge. San New Haven and Flattood Ballroad brage. Sail Juan and Culebra are unnecessary and unused; while Cavite, at Manila, has cost the Government since 1898 eleven millions of dollars.

HILE the value of a higher education is in our day fairly generally assessment there are THILE the value of a higher education is in our day fairly generally appreciated, there are not wanting soices that ask:
"What gain does this education brings to the individual? Is it not true that we see men of little or no schooling winning in the nece, over others will have had every opportunity that institutions of learning can offer? Nay, more, are there not numberless instances of men to whom thele very odwartion has been a stumbling block, when it has made hind to omportunities recommend and select upon blind to opportunities recognized and seized upon by their more alert brothers of less schooling, and perhaps more common sense? Do we not see edu-cated men following after dreams and visions, while their more practical, though less crudite fellows are gathering a material harvest?" In brief: "Is education on the whole conducive of success?"

If by education were meant an ideal education, we should hardly hesitate to answer with an emphatic "Yes." In so far, however, as actual education phatic "Yes." In so far, however, as actual educa-tion departs from the ideal, there will, of coursbe instances in which it fails to lead to the highest degree of success that might have been attained with a given raw material under prescribed circumwith a given raw material under preservoed circumstances. This accounts, at least in part, for the more thoughtful of the doubts and criticisms to which we have referred. Not so for others. The fallacy of these is the narrow, distorted and falsopout of view from which they are framed. It must be true, and indeed it must be true, that, counting only the material advantages accruing to the indi-vidual, education in isolated cases will bring loss rather than gain. But do these material advantage to the individual alone measure his "success"?

To cast a sound judgment on this question, we

must put away the personal point of view, whether centered about our own self, or about some other specific individual, in whom perhaps we are personally interested. We must endeavor to see things in their true perspective, with a wider outlook from the point of view of the community, of the na tion, of mankind.

To the educator, whose function it is to assist up olding the raw material of his generation, and molding the raw maternal of his generation, and who, from the nature of his activity, is brought to view classes of individuals collectively, this point of view must be perfectly familiar. Is it not an obvious sign of some imperfection in the methods or materials with which he has worked, if this or that individual of his charge in later years accumu-lates personal profits at the expense of his fellows without due compensation? Yet, so long as he keeps within the law and accepted custom, he may do this and be reckoned by many a "inecess," because this take only a personal survey of the situation and take only a personal survey of the situation and lose sight of the interests of the community.

While flagrant breaches of the principles implied above are recognized by all as eriminal, it is far from being generally understood that every "success," which is success only from a personal stand-point, is in fact a failure. The truth of this is pentage in race a limiter, the truth of the sep-perhaps more easily seen by referring to excep-tional cases, in which the values involved are so great as to be patent to all. We read in Tvindall's biography of Faraday: "This son of a blacksumb had to decide between a fortune of \$250,000 on the one side, and his unendowered science on the which the chose the latter, and died a poor man. Was Faraday, therefore, a failure, or would be not rather have been a sad failure indeed, had be amassed several times the sum mentioned, in an occupation that had prevented his giving to the world those classical researches which form the very foundation of modern electrical theory and practice? For surely, in proportion as a man finds a sphere of action in which his services to meaking approach most nearly the utmost of which his nat-ural endowments and his development render him capable, in so far has he achieved success

But, some may say, barring exceptional cases, is not the world's estimate of the value of a man a very fair approximation to the truth? Is not, in general, the price of a man's services very nearly equal to their value? If so, then his success, as de fined above, will be greatest when he is earning a maximum-so that we come back to a very ordinary conception of "success."

To this the reply seems to be, that the world's estimate of a man's services is indeed, broadly speaking, a fair approxumation to the truth, in most cases, but we are not here concerned with the case that represents the rule—there seems to be a fairly general agreement that as a rule, a higher education is an aid toward success; the cases which are of integest in our present discussion are the excep-tional cases, in which apparently the result of education has been to handicap the individual. Is not the explanation of at least some of these cases to be found in the disparity between the value of services readered and their market price? It must be remembered that market price depends upon human judgment, which is fallible, while absolute value is should be reckoned among successes? And perhaps conversely, do we not often hastily pronounce a man a success because of his accumulated profits, with-

and counting the cost to the community?

And what is our conclusion in fine? Education, in so far as it approaches the ideal, is unquestionably conducive of the highest success, if only we have the right idea of what constitutes success: Your success is measured, not by what the world gives to you, but by what you give to the world

at Airship Disasters

N our last issue we published an article by Mr. Carl Diensthach in which the disasters that had befallen the new Zeppelin, the "Parseval II.," and the "Morning Post" airships, were critically commented upon. We publish herewith two illustrations which help to bear out the contentions made help to bear out the concentions made in that article—that the airship is in-herently safe, but that the methods of docking it, depending, as they do, upon the concentrated action of many men, are hopelessly crude.
The "Morning Post" airship, which

was built by the Lebaudys, has had the usual trials and tribulations. At

the very end of its fine journey from Moissons to Farnborough, in 1910, the vessel was wrecked in docking. An iron girder projecting from the roof of the shed ripped up the envelope. When the renairs completed, which took several months, an ascent was made with Louis Capazza in charge. maneuvering at a considerable height, it was decided descend. Near the ground the engines were oped. Three times the soldiers below tried to grasp the tow ropes and to pull the craft down. The great ship drifted past them, the guide rope trailing across trees and sheds, with the result that the vessel was swung around broadside to the wind, all but un-manageable. The 200 horse-power engines were started up again, but not until it was too late. The ship crashed into some fir trees, the envelope was plerced, and the craft dropped, a mere mass of wreck-age, in front of a cottage. Fortunately, no one was ined. If any airship mishap ever indicated the necessity of a more efficient means of bringing a huge aerial vessel to anchor, surely this disaster indicates it.

Time and time again the Scientific American has pointed out that an airship should be moored to an anchoring tower, around which it can swing with the wind, as unhampered as a weather vane, and from which it can drift away when starting. The ac-companying picture of the wrecked "Deutschland" is an argument in favor of that plan. To prevent the wind from forcing the airship against one of the walls of the shed while it is partly within the shed, a wind break was erected, which appears in our illustration as a wall-like projection from the entrance. It was this wind break that proved the "Doutschland's" undo-ing. A heavy gust of wind caught her and pounded her down on the sharp edge of the wooden wall. As a result, the back of the vessel was broken. It is reported that two hundred men were unable to hold the craft down.

The Paris-Madrid Aeroplane Race

THE first of the series of big cross-country aeroplane flights scheduled for this summer—the race from Paris to Madrid—was started from the aerodrome of Issy-les-Moulineaux early in the morning of Sunday, May 21st. A vast crowd of 200,000 people surrounded the aerodrome, and was kept back from the lines with difficulty by the soldiers. In order they might see the start from a position of advantage the French Premier, M. Monts, and the Minister of War, M Berteaux, with their friends, took a position inside the lines about half way down the In a fresh breeze of 17 or 18 miles an hour,



Front view of Morane monoplane fitted with a Gnome motor.



Vedrines in flight



vinner of the Paris-Madrid race at 60 miles an hour.

the first four aviators me cellent starts and got away without difficulty. The fourth, M Pierre Vedrines, in his Morane monoplane, in which he has of late made many remarkable flights, was obliged to descend before reaching the end of the field, and his machine was badly damaged. The next of the twenty entrants to start was M Emile Train, one of the newer French constructors, who has met with considerable success of late and received an order for 15 machines from ceived an order for 10 macmines arount the government. With his passenger, M. Bounier, beside him, Traih rose readily and started down the field Just then, seeing that the crowd was encroaching, some curaissiers galloped across the codes to drive the people back. At the

aerodrome in order to drive the people back same moment Train's motor failed him and his machine began to descend Fearing lest he should fall upon the soldiers, he swerved to the left and landed directly in front of the ministerial party, who were unable to get out of the way Premier Monis was knocked flat by his son and thus was saved from serious injury, but the monoplane struck the Minof War squarely, the propeller severing one arm as though cut by a surgeon's inife. His head was crushed, and he was killed instantly.

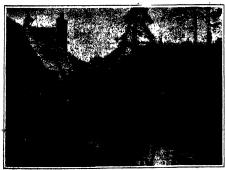
It was at first feured that the Premier's injuries

prove fatal also, but fortunately this was not The race was postnoned until the next day, when Vedrines started again on a new Morane monoplane and made a very fast and successful flight to Angouleme, 279 miles away, in 3 hours and 43 minutes, at an average speed of 75 miles an hour.

Of the four aviators who started Sunday, M Roland Garros was the only one who reached Angouleme the same day. He made the flight in 5 hours and 1 minute, requiring an hour and 18 minutes longer with his Blériot than Vedrines required with his Morane M. Levasseur lost his way in a fog and landed near Cosne, 100 miles from Paris Beaumont (the pseudonym taken by Naval Lieut Conneau) descended at Azay-sur-Imbre (90 miles), and in at-tempting to resume his flight, he damaged the left wing of his Blériot by hitting a tree. M Gibert reached Pontlevov some 110 miles from Paris, on the first day On Monday he continued his flight with his Biériot, reaching Angouleme at 10 54 A M In doing this, he lost his way and landed at Brezay, near the island of Bouchard After inquiring his way he resumed his flight and landed safely at Angouleme His time for the flight is given as 8 hours and 55 minutes On account of his accident on Sunday, M Train withdrew from the race Ved-rines tried again, however, as mentioned above, and his partner, M Frey, in another Morane monoplane, followed him at 2 06 P M He only succeeded in reaching Etampes, some 25 miles from Paris, where his machine was caught in a squall and plunged to

the graund, luckily without injury to the aviator
The second stage of the Paris-Madrid race, namely from Angouleme to San Sebastian via Bordeaux and Biarritz, was flown on Tuesday, May 23rd, successfully by Vedrines, Garros, and Gibert Vedrines was the first to arrive, although he was the last to leave Angouleme, at 7.10 A. M. He covered the 190 miles without a stop in 3 hours and 49 minutes, arriving

(Continue i on page 46.)





Wrecked frame of the British dirigible "Morning Post." Wreck of the Zeppelin airship "Deutschland IL" WRECKED AIRSHIPS AND THE WINNING MONOPLANE IN THE PARIS-MADRID RACE



Two targets being towed by the battleship "South Carolina."

I T18 fitting that in those days target practice should be attracting more attention in the United States Navy than any other feature connected with the active operations of the fleet in commission. For every school boy knows that it was to the proficiency of the American gunners that our ships in the war of 1812 were indebted for many a victory

The first opportunity afforded to American officers and crews to demonstrate their marksmanship with modern rified guns of great power was at the battle of Sanliago. Most of the fighting on that occasion was done at the very short ranges (for rified guns) of 2,000 to 3,000 yards The day was clear and our gunners were not hampered by a storm of well-aimed projectlies from the enemy So in-

efficient and demoralized were the Spanish gunners that they forgot to change the sights on their guns as our ships closed in to short range; and consequently their shells flew high, passing over the American vessels.

Instead of dispersing radially as they cleared the harter extrance, the Spaniards assumed in single column parallel with the coast, our ships following column parallel with the coast, our ships following in a roughly-parallel column formation (losing in its short range, our ships proceeded to pour a storm of shell, big and little, into an enemy that was steaming abreast of him and unable, because of the eshore, to do naything but take what was coming

Now it will be evident to the veriest tyro that as far as the American gunners were concerned, the "tar-

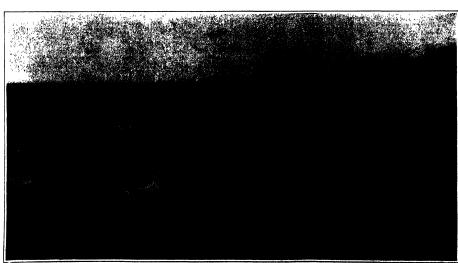
get" conditions were everything that could be asked, including, as they did, a clear atmosphere, short range, ample time, and an enemy that was too much rattled to hit back.

But what was the result? Out of the total number of projectiles (If we remember rightly, about 9,000) fired at the Spanish ships at what to-day would be point-blank range, not more than 3½ per cent touched the Spanish ships.

the spanish ships.

In other words, out of every one hundred shells fired at this practically helpless quartette of fleeing vessels, minety-six and one-half missed them altogether and embedded themselves in the wooded slopes of the southern shores of Cuba

These are facts that have never been disputed, and



The dark masses are not powder smoke but red-hot gases which, because of their color, appear dark in the photograph. At the instant of discharge the gases are white-hot,

The patch of white is gas from a gun discharged a fraction of a second later than the other guas.

sinded, only last week, Mr. Meyer, the present Secretary of the Navy, at the annual dinner of the Economic Club, New York city, gave 3½ per cent as the official estimate of the shooting efficiency of our navy in 1888.

It is not our intention to give here any history of the development of target practice, with the corre-

sponding ries in efficiency of gunnery in the United States Navy. It is sufficient to say that in the intervening dosen years or so since the Santiago battle, our shooting has so far Improved that, whereas at that time the record stood at 3½ per cent of hits at 3,000 yards, to-day it stands at 31,2 per cent of hits at 10,000 yards. This last record was obtained in target practice carried out under what are known as "battle practice" con-

In battle practice, an effort is made to reproduce, as far as possible, the exact conditions which are liable to exact conditions which are liable to be met with in time of war. During hosematic that the product of the exact control of the exact course will be known. The American admiral may deem it advisable to force an immediate engagement, and, following the time-honored principle of our naval commanders, that the best defense is a very vigorous offense effected at the earliest possible moment, he will open the engagement at the longest possible range at which his big guns will be effectly. At the longest possible range at which his big guns will be effectly at the longest possible range at which his big guns to 14,000 yards.

Furthermore, it may well happen

Furthermore, it may well happen that the enemy will be discovered in rather stormy weather, when a considerable see as running and the ships are rolling through an angle of many degrees. In this case, to the disadvantage of a far-distant target will be added that of an unsteady gun platform; and it can readily be underatood that under such conditions, only a gunner who had received careful training under similar conditions during times of peace, would have any chance whatever of damaging the

The very interesting set of views which we publish in this issue illustrates the methods by which our officers and men are trained to such a degree of efficiency that they can go out upon the high seas in search of the enemy's fleet, and just as soon as he is sighted, even if he be seron or eight miles way and the seas are running high, he able in a very short time to determine his distance, and pour in upon him a storm of heavy armorphism is high-explosive, 12-inch armorphism is high-explosive, 12-inch

The target consists of a steel pontion with pointed bow and stern,
which is ballasted until its deck is
awash. Mounted along the center line
of the pontoon is a series of tail, stout
masta, across which are fastened times
of light wood scantling. Over this
framework is drawn a large, net, and
upon the netting from top to bectom
of the structure are placed three vertical strips of caturas, one at each
end and one of the center. The target as thus formed is a parallelogram
of feet in within and extending 30
feet in within and extending 30
feet above the surface of the water
it is towed through the water by a
powerful tag, or a cruiter-upon the
after-deck of which is stationed a
observation parity, whose duty it is
to observe by the splash just where
the projectiles strike the water, that
is to asy, whether they fall 500, 200

B

Observal

Observal

Observal

Observal

Observal

Observal

Open to the target,
or whether they fall so many yards

By only the point at which the shell strikes being

beyond, the point at which the shell strikes being shown by a vast column of spray which rises far into the air.

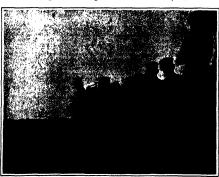
Battle practice is now carried out preferably in rough weather; for it is assumed that it our gonners can hit the target when the ship is relling or pitching do a seaway, they can ceruainly do so in calm water. The target, then, is being towed at an unknown speed, which may be anywhere from 4 to 12 knots. The ships that are to engage in the firing steam on a course approximately parallel to that of the target, at a distance which is not known to the ship, and which may be anywhere from 5,000 to 13,000 yards. The distance or range is first approximately deterulated by a mechanical range-finder, in which the



The man at this 7-inch gun is in communication with the central station by means of voice-tubes through which he is given the range.



Lowering the net on a target after it has been riddled by shells



Observation party on quarter deck of towing ship plotting on a spotting board the fall of the shots at target.

BATTLESHIP PRACTICE IN THE UNITED STATES NAVY

angles sighted at the two ends of a base line of known length are used to calculate the distance. The base line may be a horizontal line of 500 feet, which is the length of the ship, or it may be a vertical line of 100 feet or so afforded by the mast.

The modern basket or lattice-work mast, which forms such a distinguishing feature of American battleships, plays a most essential part in target

practice. On top of this mast is what is known as the firecontrol platform. On the platform are certain officers provided with powerful telescopes or field glasses, whose work it is to observe from their loty point of vantage, where the projectice fail. This they can do by observing the splash. After the column of spray has subdied, it leaves a whittish patch on the

ocean, and the officer, through his glasses and by virtue of his long practice, can tell with remarkable accuracy how far this patch of water lies in front of or beyond the target.

After the mechanical range-fluide has given the range as, say 10,000 yards, a single gun la elevated to the proper degree for that range, and a trial abot is fired. If the splash falls 200 yards short of the target, the guns are elevated by the right amount to make the next shot a hit. If the shot is 100 yards beyond the target, the elevation is reduced correspondingly.

The observing officers on the platform, however, are 120 feet above the ea, whereas the 1546 h guas in the ea, whereas the 1546 h guas in the platform, and some of them fully 300 feet away on the quest-cleck. It is necessary that means be provided for leatantly communicating to the turrets the results of the fire-central observations. This is done in the following way. On the inside of the breastwork of the platform is a set of voice-tubes, telephones and other means of communication, which lead down to a "central station" which is station is connected by telephones and voice-tubes where the very guar position throughout the ship, and from the central station the various guamers throughout the ship, and from the central station the various guamers throughout the ship, receive the correct range for the time being

It will be understood that the firecontrol officers are very busily eaged as the ship steam, past the targed at the ship steam, past the target II may be that, as in the case of the "Michigan," when these pictures were taken, the vessel is steaming 17 knots an hour, while the target may be steaming 4 to 10 knots on a parallel but opposite course Consequently, the range will be continually and rapidly changing, and the fall of the shots must be carefully watched, and the necessary change a in elevation sent to the gunners with the least nossible delay

The recoil of-the 12-inch guine causes the ship to heel, a ten guin salvo on the "North Dakota" heeling the ship to form the state of the ship to standed by fitting the next salvo as the ship rolls toward the target 1f a series of salvos was fired on the roll away from the target, if would be possible to the terminative effect of the recently

It is probable that no other nation is carrying on taget practive at such extreme ranges as the United States It is known that the Bittish Navy rarely does any shooting beyond the 7,500-yard range, this being the extense range at which good shooting can be done in the hazy atmosphere of the North Sea, and it is for the North Sea, and it is for the North Sea bastle that Great Britain is holding herself prepared. The SCHATTICE ANDREAS is often asked to compare target practice results in our navy with those of the difference in thranges and in the weather conditions, it is difficult to do; but, in two of the fart that our battle practice is done in rough weather, and at range of from 5,000 to 13,000 wask, and that under these adverse conditions so high a preventage of hits is obtained, it is

safe to say that the United States gunners stand at least abreast of those of any other navy

In estimating the importance of the new standard of efficiency in long-range gunnery, we must remember that our new 50-calher 12-inch gun will penetrate the armor of most battleships, even at great distances; and the new 14-inch gun will penetrate any armor at any range at which the hulls of the ships are visible.

The New Ship Canal and Locks of the St. Mary's River

Construction of the Longest Lock in Existence to Accommodate the Great "Soo" Traffic

By James Cooke Mills

NEXT to Panama the most important and externative engineering work now under way by the Pederal Government is the new ship canal at the falls of the St. Mary's River. This waterway of the North, connecting Lake Superior with the lower lakes, already floats in its two canals with three looks taggreatest commerce of any inland waters of the globe. In 1910 the tonnage amounted to \$2,363,138, which was two and one-half times greater than that of the Kiel Canal. It exceeds the commerce borne by all the ships, British and foreign, entering the ports of Great British in an entire year. The lake merchant marine in tonnage and value is more than one-half of the entire shipping under American registry, and exceeds the whole marine of every foreign nation, excentire England and Gorman.

The commerce of the Great Lakes, which now reaches 50,000,000 tons annually, is about one-sixth of the entire freight movement of the United States. It the entire freight movement of the United States. It of the consists of tron ore, real, grain, flour, number, sone and descending the control of the common states of the states. It is also what transportation of this enormous connages effects a saying to the American people of \$850,000,000 vearly, or more than one multion dollars were day

during the season of narigation. Nearly sevent
per cent of this commerce
flows through the St.
Mary's River, the dredged
channels of which are 34
miles in length, from 300
to 1,000 feet in width, and
afford a minimum depth
of 21 feet. The 800-foot
ore carriers load on this
draft about 13,000 tons or
435,000 bushels of wheat.

These bulk cargo ships, which are the largest of their class in the world, have a molded depth of 32 feet, and when fully loaded to their maximum draft of 25 feet, carry 20,000 tons. For every inch of increased draft over 21 feet, about 150 tons can be atowed in their capacitous holds, and they steam through the open lakes at a speed of ten to twelve miles an hour. By mechanical means they load at the mammoth ore or coal dorks in two to they coal dorks in two to three cases.

hours, and discharge their cargoes in from four to six hours. Within five years the rock cuts of the St. Mary's River will afford a depth of 25 fest at low stage of water, and the new canal and locks, which are to be even longer than those of the Panama Canal, will pass these huge freighters loaded to their full capacity, which is their highest economic efficiency.

The present canals around the falls, one on each side of the international boundary, have a combined capacity of about 75,000,000 tons in 240 days—the average season of navigation. On the American side the canal was dug by the State of Michigan from 1853 to 1855, and was the first ship canal made within the borders of the United States. It was originally a little more than a mile in length, 64 feet wide on the bottom and 100 feet on the surface of the water, and 13 feet deep. At the lower end were two tandem locks of masonry, 350 feet long, 70 feet wide, 11½ feet deep, and each had a lift of feet.

In the early seventies the lake commerce had increased to such a volume that plans were drawn by the government for a new look, the construction of which was begun in 1876 and completed in 1881. It was named in honor "I General Godfrey Veltzol, U. S. A., who was in charge of the work. This look of solid masonry is sit" in use, and is 515 feet long, 80 feet wide, narrowing to 60 feet at the gates, and affords a depth at present lake levels of 15 to 16 feet. The canni was widened at this time to 150 feet, with timber piers having a vertical face, and the depth increased to 16 feet. In 1881 the control of the canal passed to the United States Government, and the toils, which in twenty-six years amounted to \$500,000, were forever abolished.

The great Poe look, which is the largest in the

world, replaced the State locks, and cost, including fits canal enlargement, \$4,765,000. This work was collected in 1898, and has proved the greatest communication in waterway transportation. The lock is \$500 feet in length, loff set in width, and affords a depth of 1914 feet at extreme low water level. It will pass in one lockage, requiring less than 300 minutes, four reasels, two abreast, of length 380 feet, beam of 45, and carrying in the aggregate 30,000 tons. The cost per freight ton has thus been reduced from 12.37 mills in 1883 to 3.58 mills in, 1996. During this period the wooden steam barge gare way to the modern steal ship, and the freight charges per mile-ton dropped from 2.3 mills to 0.78 of a mill.

room 2.3 mills to 0.78 of a mill. In 1896 the freights to and from Lake Superfor averaged: On coal, 31 cents per net ton; from cre, 50 cents; grain, 2 cents a bearing; muber, \$2.40 per theusand fost board measure, and general unerchandine, 52 per ton. These rates, which for an average haul of 800 miles are far below any railroad competitien, are determined by the law of supply and demand, that is, the tomage offered in relation to the commerce in sight. It is thus perfectly clear that the expenditure of \$15,000,000 to the beginning of the present projects, for the improvement of

ANT MARY DE LANGE

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The Wettzel lock is 515 feet by 80 feet by 18½ feet deep; the Foe look is 800 feet by 180 feet by 18½ feet; and the new lock now being built by the United States government is 1,300 feet by 90 feet by 90.5 feet. It will accommodate two 600-feet ships each carrying 80.000 tons at one lockage.

NEW 1,850-FOOT LOCK AT SAULT STE. MARIE—WILL BE THE LONGEST IN EXISTENCE

interlake navigation, has been returned a hundred fold in direct benefit and saving to the American people. On the Canadian side of the falls, the ship canal

constructed by the Dominion Government from 1888 to 1898 is an important factor in lake commerce. It is 1½ miles long, 150 feet wide, and 25 feet deep, with a lock 900 feet long, 60 feet wide, and that a depth of 20.3 feet at extreme low water level. It affords about 5 inches greater depth than, the Poe loot, and for this reason mearly all the 500 and 600-foot ore ships now load for this foot. Of the average number of vessels passing the three looks each day, which in 190-10 was 24, 77 were looked through the Canadian canal, and 57 through the American canal. The though 49 per cent of the total tomage, although 49 per cent of the total tomage, although 49 per cent of the aggregate was freighted in American although 49 per cent of the aggregate was freighted in

The first undertaking of the present projects, which have been under way since 1907, and will not be considered until sour 1918, was the widening and despesing of the old vanal above the locks, which involved not specificate of \$3,000.00. This work was completed late in 1910, and the new channel north of Bridge Island was used for the first time on the opening of navigation this year. The necessity of this improvement has long been left by the vessel distesses, as considerable delay and damage has been considerable of the safety of the surface of the surf

The construction of the new channel was a swist of some magnitude, the excavation being in shall solid rock, and was done in the dry beliefs strong.

collectains. Beginning at a goluit next the north pier above the upper gates if the Fee leist, the exaction extended westerly to the bend of the canal, which was extended to make the wisterway 1,1% miles long. A new north his we seeming the convex along the north-edge of the canal, which was extended to make the wisterway 1,1% miles long. A new north his of the was related at convex along the north-edge of the canal, short the leist large for a feet of the seast form 120 feet at the bridge to 170 feet. This left the swring bridge pass and the new movable dam in the middle at the canal, instead of on the old north pier. The saw prime was then elseand out, waster was travauld in, the old north pier was taken out, and the edifurdants proved, Dredging out the old ciannels to a uniform depth of 25 feet completed the unlargement. The seasal is now 900 feet with as the upper entirence, 170 feet at the best, 106 feet at the lock gates, and 1,000 feet wide at the lower entrance.

As important as this improvement is to the lake shipping, the greatest project is the new canal with its manmoth locks. The older davantage of a separate and free waterway constructed into the rapids the in having at all times a uniform and dependable supply of water to feed the new locks, whereas, by tak-

old enlarged canal, er roused. Experience has shown that when both the at looks are b filled at the same time, the drawing down of a great quantity of water in the upper canal creates strong currents at the bridge, which endangers vessels passing through the narrowed channels. the narrowed channels.
And then, with one case! for all locks, in the event of the sinking of a ship or the wrecking of a lock gate, navigation would be entirely interrupted on the American side, while with independent canals, only looks would be us for the time being. The probability of such acci-dents occurring in both canals at the same time is very remote.

The new canal will be 260 to 300 feet wide, and will have a minimum

depth of 25 feet at low-water level. Excavation of the prism through solid rook is progressing rapidly, and the building of the dyke for the water-power canal has been completed to a point opposite the power station in the rapids. The gates to connect the dyke with the station will soon be set up, and the new power canal put in commission during the summer of 1911. The station will soon be set up, and the new power canal put in commission during the summer of 1911. The station was a station will solve the bridge with material excavated from the old and the new canals has been so extensive as to shart of a large five with waterial excavated from the old and the new canals has early the two dyke, which actends well into the middle of the rapids. The extension of these engineering works into the rapids, which are in the middle of the rapids. The extension of these engineering works into the rapids, which are in the middle of the supper lake for the requirements of the lookinges in the glip canals, but has a sateguard the amoint of water which may be drawn through the power chanle is regulated by the covernment, and is gazed by the electricities of the locking o

is regulated by the government, and is gased by the Succinations of the level of Lake Superison. The new Daris lock, now under opistruction, will be 1,800 feet in length, 80 feet in width, and allowed \$1.5 test of the length of the width, and allowed \$1.5 test of the length, 80 feet in width, and allowed \$1.5 test of the length of 1,800 feet will peas is a single lockage two vessels, each 650 feet long, and 70 feet beam, levistians which before long will be ploughting the label and sea, laden with \$1.50.00 feets of long levistic length of the largest hope of the plant became of the levistic long of the largest length of the largest hope ear, mediag is full trains nearly four miles long. The will slow a sufficient the Lake Superison gate to Cloveland would only about \$1.5 test length of the largest length would not a sufficient the Lake Superison gate to Cloveland would come on the Constant South of \$1.5 test length of the superison of the largest length of the largest length

The right of the new lock, 60 feet, will not see the second of the control of the of 260 feet

The third independent project, the work of deepening and widening the Middle Neebish channel in St. Mary's River, has progressed rapidly to completion. and the last section at Salior's Encampment will be finished early in 1911. The improved channel is 300 feet in width, and has 22 feet of water over the rock bed at mean low stage level of Lake Huron. The improvident to the channels of this great highway of commerce still goes on to the ultimate deepening to 35 feet, which will greatly relieve the congestion of traffic of the two constantly passing processions, both night and day, of the splendid merchant marine.

Mrs. Fleming

By Annie J. Cannon, Harvard College Obse

THE name of Mrs. W. P. Fleming of the Harvard A Observatory will always be intimately associated with the early history of the new astronomy. Born mdee, Scotland, in 1857, she came to this coun try about thirty years ago, and soon drifted into at was destined to become her life work by enaz upon some astronomical computations. the time was ripe for new and remarkable methods of stellar investigations. The spectroscope had already begun to answer the long standing question of the ages as to what the stars are made of. photographic plate was to constitute the next im-portant aid in astronomical research. Experimental celestial photography had already been undertaken at Harvard, but not to any extent until 1882, when Prof. Edward C. Pickering, the present directs commenced his systematic patrol of the sky, whiwas greatly sided in 1886 by the generosity of Mrs. was greatly studen in 1880 by the generosity of are. Draper in establishing the Henry Draper Memorial. In a short time photographs of the stars were being taken every clear night by Prof. Pickering's assistants, according to his plans. After development these photographs were placed in Mrs. Fleming's hands. Her aptitude for the work was at once ap-parent, and her ability to think quickly and clearly, proved invaluable in the organization and execution

of this pioneer work.

A large number of the Harvard photographs are taken with a prism placed before the object glass of the telescope, so that the light of each star is spread the tensecope, so that the ign or each sur is spread out into a band, traversed by lines, dark or bright. With rare keenness of vision, and alertness of mind, Mrs. Fleming soon grasped the interpretation of these lines of light. Her strong individuality and absolute fearlessness were of special use in early days when the new methods were ignored and often attacked by devotees of time-honored customs when new stars were openly accused of being defects on the photographic film, and variable stars discov on the photographic nim, and variable stars unever each photographically were sometimes omitted from the catalogues. But she never doubted herself. Day by day, rear by year, with magnifying eye-piece in hand, she examined the photographic plates, marking any object that appeared to be peculiar, as perintending the confirmation of unusual objects, until our knowledge of the siderest universe was greatly increased. Only two weeks ago, although under the shadow of the fatal illness, she worked with characteristic hravery on the proof of a volume of the annals entitled "Peculiar Spectra." This volby her during all these yeard while examining the Harring all these yeard while examining the Harring photographs. They include gaseous nebule attracts having bright hydrogen lines, stars of the fifth type, variable stars and Nova.

largest pieces of astronomical work were the They issue stood to be a second of the secon

pieces of routine work the observatory has carried through, and much of her time was spent on the proof of the numerous annals of the observatory. The value of her contribution to the progress of astronomy has been recognised in various ways. omy nas need recognised in various ways. In law the Harvard corporation gave her the official appointment of Curator of Astronomical Photographs, under which she had the responsibility of the care of the unique astronomical library containing over 200,the unique astronomicas durary containing voice and a door photographic plates. In 1906 she was made a foreign associate of the British Royal Astronomical Society, and, shortly after, Wellesley College bestowed upon her an Honorary Fellowship in Astronomical Society. tronomy. A few months ago the Astronomical clety of Mexico sent her a gold medal in honor of her discovery of new stars.

Although the greater part of Mrs. Fleming's life as spent in the routine of modern scientific work. yet the human element was never lost in the scientist. Her great love of flowers and of her home, as well as her unusual skill in the use of the needle, prove that a life given to science need not destroy rnal feminine." Many a dainty bag, ex-finished, or doll dressed in a complete "eternal feminine." Scotch Highland costume, went from her hands to friends far and near at the Christmas season. Because she was so intensely human, and brimming over with life, she won friends easily. No visitor to observatory will ever forget the warmth of her greeting with its pleasing Scotch accent, the cheer of her laugh, or the personality of her sympathetic nature.

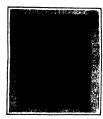
Correspondence

A Gas Engine Suggestion

To the Editor of the Scientific American:

With the object of increasing the power, or lowering emperature, steam combined with the products of combustion has been experimented with in internal bustion engines.

Would you allow me space to outline a cycle in



View of piston and cylinder head for proposed gas and steam motor.

which a portion of the heat now wasted would be used to generate steam within the cylinder, producing an impulse of equal or greater power than that an impulse of equal or greater power than that resulting from the combustion of the fuel, with which would be alternate? I will refer to one as the steam, to the other as the gas impulse.

To attempt this I would propose to employ v might be compared to an inverted trunk piston, which would consist of two parts, rigidly attached, but in sulated one from the other. One part would consist of a comparatively narrow piston, the other would form a cun open toward the cylinder head: the cun to be made of some alloy which, while a good conductor of heat, would withstand a high temperature; the central part of the cylinder head to be depressed, so that at the end of the stroke it would occupy more or less space within the cup; the proportion with regard to depth which one would hear to the other depending on the size of the combustion space re quired, which would be formed between them at the end of the stroke; the injet and exhaust valves, the fuel and water spray nozzles to pass through the

When starting, the engine would be operated by the gas impulse alone until the cup had acquired a sufficiently high temperature, then, following the stroke which discharges the products of combi heated water under pressure would enter the cylinders, the object being to spray the entire unpolished, and possibly corrugated, inner surface of the cun and produce saturated steam with extreme rapidity the water bursting into steam of as high a temperature the water newting into seem of as high a temperature as it is possible to work with. If some of the spray were less find than the rest, the formation of steam might be prolonged. Some heat would inevitably pass through the cylinder walls. By jacketing, a portion of this could be utilized to raise the temperature of the feed water to a point below 212 deg F; if too hot it would form steam too readily. It must enter the cylinder as hot as possible, but as water. When all the water had been vaporized, the steam would superheat while expanding for the remainder of the

The present four-cycle engine would become a six-ycle, the two a four, the latter that type of large engine in which the air is separately compressed. The valve-operating mechanism would be more complex, as while the exhaust valve might be timed to suit both impulses, the air and fuel for one impulse, and the water for the other, would require separately timed.

Possibly with separate compression the clearance between the cup and cylinder head might be less, the scavenging would then be more thorough, and the steam would attain a pressure with greater case in the more confined space; the air being admitted for a portion of the stroke before combustion took place. A dangerous temperature within the cylinder might be detected by observing the temperature of the exhaust steam. All would enter the cylinder when the temperature of the cup was lowest.

The temperature of the exhaust steam although superheated, would be much lower than that from the gas impulse; combined, they might be passed through

Given three equal quantities of fuel oil, let one be burned beneath a boiler, the second within the cylinder of a gas engine-a Diesel engine, for instancewhile the third is used in an alternating engine. the type proved practicable, might it not be possible eventually to obtain power from the last, equal to the combined output of the two former? Steam generated and expanded within the cylinder might be used at a much higher temperature, and consequently pressure, than is now feasible, more than compensating for a slight loss which might be expected in the gas impulse

The proportion of water to fuel to produce steam of a given temperature, whether the alternations be obtained with sufficient rapidity, the mass of the cup and other points, could alone be determined by

Brentwood, Cal

How to Handle a Zeppelin To the Editor of the Scientific American

Reading this week of the disaster to another of the Zeppelin airships made me think of a plan by which such a disaster might be avoided 1 am not an in-

ventor nor a machinist, and the plan might not worth consideration. I am going to offer it never-It seems to me that a couple of hundred men hang-

ing on to a rope is a mighty crude way of handling the ships Why not have a heavy steel car with a strong motor, or more than one car, running track under the ship? If necessary to gain tra If necessary to gain traction power, have a system of cogs that would prevent any backward motion under a heavy gust of wind, such as wrecked the ship the other day If there would be danger of the ship lifting the car from the track, put a third rail between the other two tracks and lower. Reverse this third rail and have two wheels running on it and connected to the under side of the car This would be the same principle used in the hanging ertric car lines, only reversed it ought to be a simple matter to arrange a system of connection between the car and the airship by means of which they could be disconnected in an instant.

As I said before, this is only a suggestion and may not be worth the paper it is written on, and if you think so, then destroy it. D. W. B. Webster, S. D.

[The plan outlined is mentioned by Mr Carl Dienstbach in last week's SCIENTIFIC AMERICAN.-ED.]

Bacterial Lineage

THERE could hardly be a better example of the scientific spirit than the application of the methods of biometry to those excessively minute organisms. Experiments in this relation the beginning of a new era in bacteriological classification and nomenclature. There have been applied the methods used by anthropologists and students of variation and heredity to the definition of the species of bacteria. The results are, of course technical in their nature, and in themselves interesting only to students of the subject, but they have a broad general interest because they served to assure the public that advance on strictly scientific lines is being made that glay so important a part in human life and everything that human life depends upon.

The Heavens in June

Our Monthly Astronomical Page

By Henry Norris Russell, Ph.D.

ANY clear evening at the present season, shortly after dark, the most casual observer cannot fail to notice two very brillant objects surpassing all the stars, one in the southeast, the other, still brighter, in the northeast. If he is at all familiar with the heavens he will be able to identify these at once as Jupiter and Venus. The fact

that they do not twinkle proves they are planets and not fixed stars. Mars alone, besides the planets mentioned, ever appears anything like so bright; but is red, and these are not.

It is equally easy to tell which is which without recourse to the almanac. The planet in the south-east, being apparently in

the opposite part of heavens from the Sun heavens from the Sun (now below the north-western horizon) must really be outside the Jearth's orbit; hence it must be Jupiter and not Venus Even if both planets had been evening stars together, Venus once, for she is almost invariably much the brighter of the two. Both are interesting telescopic objects, but there is a great difference in the satisfaction which they afford the observer

Jupiter, though now some 430,000,000 miles away, looks just about twice as big as Venus (when viewed with the same telescopic power) though the latter is only about 85,000,000 miles from us Even at this five-fold greater distance, he former planet shows a wealth of surface detail. A very small instrument brings out the dark bands parallel to the equator, and a larger one shows many finer markings, which can be seen to move across the disk as the planet rotates.

Venus, on the other

hand, is a most unsatisfactory telescopic object. the beauty of her phases (which exactly resemble those of the Moon, and change in the same are very impressive to the

novice; but one may look at her a hundred times and see no more. She appears as a uniformly white sphere, with Himmnation shading of complemously but gradually toward the phase limb, and not a trace of definite markings Under favorable conditions vague and ill-defined darker shadings may be seen on the bright surface, but nothing at all comparable with the conspicuous markings shown by Mars or Jupiter or by the Moon to the unaided eye Why should the brightest of the planets thus reveal so little of her true character to our scrutiny? In trying to find an answer, we must bring all the available evidence to bear on the case

Measures of the light which we receive from Venus show that fully three-quarters of the light falling on er surface is sent back into space, as compared with about one-fourth for Mars, and only one-sixth in the

The planet's surface is therefore remarkably white. as much so as white paper, or as clouds, or, almost, as snow The last two substances seem to be the only ones which could actually cover a planet's surface so completely. But, since Venus gets twice as much light completely. But, since water gets twice as much light and heat from the Sun per square table as we do on the Earth, permanent snow, all over the surface seems out of the question, leaving us practically shut up to the belief that the visible surface consists of clouds These might be clouds of condensed water vapor, like our own, or perhaps, as Lowell suggests, clouds of dust or haze in a dry atmosphere. That there is an atmosout the planet is proved beyond question by the twilight effects which are visible when Venus is the twilight enects which are visible when vehicle a almost in line between us and the Sun. All the evi-dence, however (as the writer pointed out some years ago), goes to show that the extent of this atmosphere, above the visible surface, is much less than that of the Earth's above sea level; though not perhaps less than that of our atmosphere above the highest

When we come to inquire whether clouds like those which we know so well could cover the whole surface of Venus, the rate of her rotation is of great imas the earth, may fairly be compared with the latter. If her rotation was equally rapid, we would expect to find a cloudy region near the equator (warying in position with the seasons), relatively clear belts on each side, and then again more cloudy regions, with great was, and noen again more coudy regions, with great patches of white (as seen from above) where below the weather was stormy. There is no question, may Clayden, that the Earth, seen from a distance, way dappear as "a belted planet," with the slouds by far the most conspicuous feature.

the most compressors restarce.

That Years shows nothing of the sort is another proof that her rotation cannot be rapid.

On the other hand, if she kept one side always toward the Sun, the other would become intensely cold, and all the water would be fromen up there. The sunward side of the planet would be a vast desert,

over which it is very un likely that clouds form

This is Lowell's belief, which he supplements by supposing that the atmosphere above this desert is so dusty that it reflects almost as much light as clouds would do.

Clayden favors the al-ternative belief that the planet's rotation, though slow, is more rapid than the orbital revolution, so that an observer on its surface would have regusurface would have regu-lar alternations of day and night, but at rela-tively long intervals, which he estimates might be anywhere between twenty and two hundred

Under these conditions the water would not be permanently frozen on one side of the planet, oceans might exist, and hence there might be plenty of evaporation to furnish

Working out the atmos-pheric calculation, he deduces that the hottest part of the planet would be an oval area where the Sun as nearly overhead or a little past noon. In this region rising currents of air would bring up great quantities of moisture and form dense clouds.

Surrounding this in a of irregular ring would be a region of de scending currents of air, where the clouds would be thinner, and we might

perhaps see bits of the surface through them. Beyond this again they should grow denser, as far as the sunlight reached. On the dark side of the planet the sky might be partly clear. Far above these clouds, which might resemble our cumulus or "thunder heads," would be thin filmy cirrus clouds, which

would contribute their share to the reflected light.
This theory, of which only a brief sketch is given here, seems to the writer the most satisfactory one so far brought forward. It is interesting, though of course purely speculative, to consider that, if this ex-planation is correct, the real surface of Venus may se composed of land and water like the Earth's; and, under the protecting screen of clouds, life might be possible under conditions much like those familiar to us, but these very clouds would acreen it forever from

THE HEAVENS.

With the aid of our map the principal constalla-tions can easily be identified. Due south, and high toward the south, is Bootes, marked by the great red star Arcturus.

Below, on the right, is the fainter white star Spice. in Virgo, and on the left the very bright planet Jupiter. Far below, on the southern hortses, are the -Transcription of the Color of t



NIGHT SKY: MAY AND JUNE

to our answer. It used to be believed that like the Earth, she rotated in about a day; but in this case she should be flattened at the poles, and the very accurate measures made during her transits across the Sun show her disk to be apparently perfectly circular. Moreover, spectroscopic observations, at the Lowell Observatory, which would detect rotation by the fact that one side of the planet was coming by the fact that one suce of the plants was coming toward us and the other receding, indicate that the rate of this motion must be exceedingly slow, very much slower than in the case of Mars, for which the method gave a value within five per cant of that mown to be correct.

Neither of these lines of evidence shows that

Venus does not rotate at all; the observations would be explained by any period of rotation more than two be explained by any period of rotation more than two or three months long. They suggest, however, with-out proving, that, like Mercury, Venus keeps, the same alse always toward the Sun. (The observations of markings on the surface, made some years ago at the Lowell Observatory, which would indicate that this was the case, de not appear to have been nontifrance). A recent paper by the Inaglish meteorological following describes in a very interesting way the influence of rotation on the distribution of clouds on the lightest. Venus, being very nearly of the same size and made

2 / W. A. W.



[The Britter of the Home Laboratory will be glad to receive any suggestions for this department and will pay for them, promptly, available.]

A Twenty-five-cent Photographic Objective By Gustave Michaed, Costa Rica State College

COME anatour photographers take nothing but snapahets, while others, because they aim, above all, at technical perfection and have no use for underexposed negatives, take nothing but time exposures. Anasissurs of the first category need not read the following lines, as the objective described here would be, in meat cases, too slow for them. It requires 1 second to perform work which would be done in 1/15 of a second by an anastigmat used at full specture. As a compensation, when made to cover the whole plate as tharply as the anastigmat does, it has over the

as anarphy as the anasigmat does, it has over the costly objective the following points of superiority: ist. A better rendering of color. The blue sky is not made just as luminous as the white clouds Red cheeks are not made to appear as black depressions.

2nd. A greater depth of focus. The small aperture gives a better definition of any object-but of focus. 2rd. A more uniform illumination of the field. The margin of the plate is not darker than the center This again is a result of the smaller aperture.

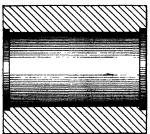


Fig. 1.—Longitudinal section of objective tube.

4th. A lower price. Twenty-five cents and some easy work is about the price paid for the home-made objective. Twenty-five dollars is about the price of an anastigmat covering a 5x7 piate or of a good rectilinear combination covering an 8x10 plate.

The home-made objective is composed of two parts: the retracting combination contained in a wooden tube placed, as usual, in front of the camera; and the screen, placed behind the lenses and close to the sensitised plate.

The refracting combination is made of two circular, periscopic, spectacle lenses, separated by a disphragm. Such a combination, has over a single lens, the advantage of a complete elimination of the distortion, together with a considerable reduction of the spherical aberration and of the curvature of the food surface.

The screen confers to the objective the qualities of being, to some extent, schromatic and orthorhromatic qualities which are incompatible from the etymological, not from the optical point of view. The screen dryes with a mamentum picrate, a yellow substance which effectively stops most of the ultra-violet and violet rays, and so weakens the blue that this color has not much after extending the picture of th

The medded material for the making of an objective which will sharply cover the Ser justs consists of two periscopic convex, two diopter, spectacle lenses, X or telf less shape (price, 15 cents the pair, sold by all manutacturing opticians), and a parallelopiped of seasoned hard wood, %2.1% x 1% inches. A hole same dismeser as less, that is about 1% inches, and about 1% finches, and less; that is about 1% inches and about 1% finches, Then a 1% kinch auguer bit is substituted for the 1½-inch bit and the hole is different to the third, then the season of the third third for the 1½-inch bit and the hole is different to the season of the seas

A STATE OF THE STA

angles with the surface. The block is then sawed transversely through its central part until the saw has passed clear through the hole, but not much farther. Two wooden strips are served on the sides of the block. They close laterally the cleft made by the saw and leave it open only on the top of the parallelopiped. Through this upper opening the disphragms are introduced and removed. There should be at least three of them, with opening 18, 674, 8, 316

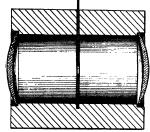


Fig. 2. - Sectional view of the completed objective.

of an inch in diameter, approximately corresponding to 1/20, 1/32, and 1/64 of the focal distance. They can be made of black pasteboard or of metal. No diaphysem should be used while focusing.

disphragm should be used while focusing

After the inside of the objective tube has been
blackened with drawing ink the two lenses are placed
as shown on Fig. 2, with their concavity facing the
disphragm. A ring of pasteboard or of wire keeps
them in place and allows of easily removing them
when they must be cleaned. The shutter is a cover
made of black pasteboard. A hole 1% inches in diamster is drilled into the center of a board about 4xi
inches, which is afterward fastened upon the objective
tube in the manner shown on Fig. 3. Four arrow
holes are drilled on the four corners of this board.
The objective can now be screwed in two minutes upon
any 5x7 canners.

To make the acreen, two of the bx's sensitized plates are immersed into the ordinary faing bath of hypountil the white bromide of silver has entirely disperand. This operation is made in the darkroom, far away from the ruby light. A thorough weaking (afteen minutes at least) in running water following. The two plates are then left, film upward, for about five minutes in the following solution: Water, 250 cubic centimeters; picric acid, 2 grammes; ammonia, 10 cubic centimeters.

Next, they are immersed for not more than two

Next, they are immersed for not more than two seconds in water and are allowed to dry away from dust. When perfectly dry, they are bound together, film against film, with simple syrupy sheller varnish. The liquid is rapidly poured over both dims, the plates are then firmly pressed against each other to drive away air bubbles. A few days later the glass is cleaned and the edges are finished with black possepartout binding.

In most cameras the acreen can be effectively and permanently kept in place by means of four thumb-tacts nailed on the inside part of the frame which carries the ground glass and its spring. The screen will then be almost in contact with the sensitized plates.

If the home-made objective is intended to cover the 8x10 plate, the following alterations must be made in the figures given for the 5x7 plate: The objective

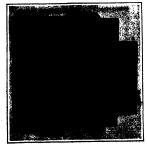


Fig. 2.-General view of the 25-cent objective.

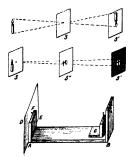
tube should be long enough to allow of a distance of 4 inches between the two lenses. These should be 1.25 diopter lenses. Pinally, the disphragm apertures should be %. % and % of an inch, to correspond to 1/20, 1/23 and 1/64 of the focal distance.

An Experimental Proof of Inverted Retinal Images

By A. H. Patterson

I all is usually somewhat mystifying to be told that unpright objects, such as trees, men walking, etc., form inverted or upside-down images on the retina of the eye. However, it is easy to construct a simple but of apparatus which will prove the point in question. But first we must understand clearly one or two principles of the action of light rays.

Take a sheet of cardboard S and plerce in it a small hole shout one-tenth of an inch in diameter. In front it place a lighted candie, and behind it a cardboard acreed S. On this latter acreen will be seen an inverted image of the candie—a so-called "plac-hole image." Now place the candie quite close to the screen S. Then take, a third cardboard screen S. and it is suffered to the screen S. Then take of the surface in the screen S. Then take of the surface in the screen S. Then take of the surface in the screen S. Then take of the surface in the screen S. Then take of the surface in the screen S. Then take a third cardboard screen S. Then take and S. The diameter, and place it between the two screens S and S. The display increase in the surface in the screen S. Then take and S. The diameter is sufficient to the surface in t



Experimental proof of inverted retinal images

of the lighted area and the cruciform shadow on s' will be altered, but the shadow will still be upright. Now for our experiment Construct of thin pleces of wood a frame like that shown in the drawing. The distance AB is about 7 inches; the hole C is about one-tenth of an inch in diameter, and DB is a piece

of white letter paper about 4 inches square, pasted over the wooden upright at the lett. At F a tiny hole is pierced through the paper with an ordinary pin. Now stick a pin upright in the block G and adjust the position of the block so that the head of the pin is exactly in line between the holes C and F, and three fourths of an inch from the hole C. Fix the block G in this position This completes our apparatus Placing the eye close to the hole C and looking through hole F at the sky, we see a lighted circular area with the shadow of the pinhead in its center, but this shadow is invested. We are ready to declare that the pin is upside down, for it certainly looks so. When we reflect a moment, however, we see that we have now exactly the same arrangement as in the middle diagram The hole F represents the hole in the screen S, the pinhead represents the cross, the pupil of the eye represents the hole in screen R", and the retina of the eye takes the place of screen S' and receives the upright shadow of the pin head upon it. The crysta'line lens of the eye acts precisely like the lens in Fig 2, altering the size of the retinal shadow, but not its upright position This upright shadow on the retina, however, makes us think that the object throwing it is inverted, for the shadow certainly "looks" inverted to us. But we know that the object throwing the shadow is upright, and it follows in consequence that the retinal images of upright objects are inverted. In using this apparatus the eye must not be focussed on the pin, or the hole F, but on something distant, like the clouds or the twigs of trees between the observer and the sky.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

A Smoke Dissipating Chimney

 $T^{\rm HE}$ age of hygiene and applied science has developed a problem of gaseous sewage, as well as one of aqueous sewage. The production of a good draft is no longer the sole or even the principal function of a factory chimney, and is of comparatively little portance in many industries, in which forced draft

Great improvements must be made in factory chimeys and other sources of smoke and noxious gases before the continual complaints and law suits provoked by these nuisances can be expected to cease Manufacturers and foresters, governmental authoritles and experts are seeking contrivances and methods by which these products can be made harmless, or

less harmful, without prohibitive expens

The greatest success may be expected from apparatus operating automatically through natural agencies with out human intervention. Hitherto, reliance has been placed almost wholly on very lofty chimneys. Until recently the tallest in existence was the Halsbrucck chimney, near Freiberg, in Saxony, which is 459 feet high. In 1909 a slightly higher and much larger chimney was erected by the Copper Mining Company of Massachusetts, and other American smelting companies are preparing to follow the example. Chimneys panies are preparing to follow the example. Cummers exceeding 150 feet in height are now very common, and a height of 300 feet is not rare. The practical limit of height has aiready been exceeded, for very tall chimners not only are inordinately costly, but they utterly fail to serve the hygienic purpose for which they are designed.

In order to make furnace gas innocuous to animal

and vegetable life by simple dilution with air, the mixture must be provery quickly by eddy currents at the mouth of the chimney, or, preferably, inside the chimney, but the higher atmospheric strata which lerced by very tall chimneys are notably free from the eddies which are produced in lower strata by convec tion from the warm soil and by hills, trees, buildings and other obstacles.

Some of the sulphur dioxide and other in jurious constituents of smoke and gaseous waste products can be removed passing the ga through water, time and other chemical agents, but it is economically impracticable the gases entirely innorto health, and especially to vegetation, by The sm this method. proportion of sulphur dioxide contained in the air of Berlin (from 3 to 5 parts in one million) is sufficient to stunt the growth of the conffers in the city parks From this and other evidence it is certain that ordinary chimney gas must be diluted with at least 100 times its volume of air less to vegetation.

Dilution to this extent is not effected by the wind as rapidly as is commonly assumed. Steamships often leave trails of dense smoke which extend for many miles. Usually the smoke is quickly diluted to a considerable degree immediately on emerging from the chimney, but the process of dilution goes on very slowly after

the smoke has attained the velocity and direction of the wind. In an article in Die Umeches. Prof. M. Wislicenus describes a new type of chimney which he has invented and patented, and which accomplish rapid dilution of the furnace gazes in the simplest manner, without chemical, mechanical or human aid.



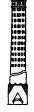


Fig. 1.—Plan and elevation of the dissipator chi

or an increase in operating expenses. In the "dissi-pator," as the new chimney is called by its inventor, the smoke and gases, instead of issuing in a compact stream from a single mouth at the top, are dis-tributed among a number of nearly horizontal chantributed among a number of nearly horizon nels terminating in orifices in the side of the chimney.

emergence, by the edds willing longuing the fr

tilliont imposing the form The upper part of the di-perforated by aumerous

have the shape of funnels, with the directed inward. Hence a wind blowle

tion streams through the chimney and he ly mixed with the bot gases and smok

rise from the unperformed part of the chimney below. Some of the amoke escapes, only alightly diluted with

some overne smore scapes, my augusty annees with aft, from the lowest openings, but the greater part of it continues to rise and to scape gradually in more and more diluted form. The formation of oddies both inside and outside the unimary is promoted by

both made an outside the dishmant as content both inside and outside the dishmant as permented by the taporing farm of the eleanness and the diversity of their directions. The -nesolite that fearness may make it within a strong winds, and cross its light winds dense amoks is elen only in the immediate violatity of the lowest openings (Fig. 3). The perferations occupy one-third or one-fourth of the ional height of the chimmer. The unperforated lower part is carried to the height required to grodue the desired draft, if natural draft is used.

The form and dimensions of the channels can be modified in various ways to increase the dissipating action. On the other hand, the efficiency of the device may be seriously impaired by unakilled construction, as is shown by the dense cloud of smoke emitted by chimneys constructed with a single tier of high vertical sitis instead of three tiers of smaller ordines. The cal slits instead of three tiers of smalle

top of such a chimney may be closed or left open, without affecting the draft in the least.

Several large chimneys of this type are already in an experiment was made an experiment was made by using fuel which pro-duced a great deal of smoke. The result was a remarkable sheet of dark hine smoke wav-ing like a flag on the seeward side of the chimney, but extending only to a distance of 40 to 60 feet, while an ordinary chimney, in these cir-cumstances, would have emitted a column smoke a mile long.

When forced draft is employed, the dissipating action may be increased by building several low erforated chimneys, one the othe "multi-dissinator" of this construction, shown in Fig. 4, has proved very satisfactory in a large German dyeing and bleaching establishment.

The principle on which the dissipator chimney is based—the rapid com mingling of gas Houlds by the mechan ical agency of variously directed currents -- can be applied to the diffu sion of sewage in streams, the abstement of the smoke of automepurposes.

The chimney pouring forth a long column of dense smoke, which adorns so many adversarded with pride,

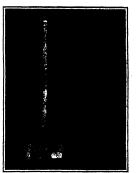






Fig. 4.- A "multi-dissipator " shimner. Fig. 5.- Another rice of \$



Fig. 8. -- Analyzing the smoke and gases

A SMOKE DESERVATING CHIEFER

Wind Fur

ONE of the early of sheet trainers of a dream

the second of the horn, was covered with small by the mean said the coal. The theory of the appearance was that its possible form would create such that the possible form would create such that the second form and of the horn that the real still be completely consumed. As the wind connected with a common way processes was processes was processes was processed on the medical state of the processes of the second with a common to proceed with a common to proceed with a common to proceed the medical state of the common throughout the medical state of the processes of the heavily and furnace from the Stone graph of the common throughout the second common throughout the present the second common throughout the present the second common throughout the second common through the second common throughout the second common thro

development to the neutra and turnace from the stone and the middle of the 18th century. According to Register, the journal of the exhibition, an experiment, made with this model resulted in the production of dense and stifling smoke. The wind furnace made it possible to burn mineral coal, but this was its only ority ever the ancient charcoal brasier, which

A Radjum Inhaler

It has eften been observed that bottled mineral waters are less efficient in the treatment of certain diseases then the same waters drunk at the spring. diseases the same waters truin at the spring. It is insown, also, that most mineral waters are more or less strongly impregnated with volatile radium emanation, which energes and decomposes before and after bettling. These facts led Dr. A. Bickel, in 1905, to try the remedial effect of water artificially im-pregnated with radium emanation obtained from radium bromide. This water was employed with suc-cess is some diseases of the stomach and intestines, in goot, rheumatism and neuralgia, and in some cas of cancer in which operations were inadmissible. At first the water was administered only by the stomach, but it was subsequently employed in the form of baths also. From the latter use the inhalation treatment naturally developed, as the bather necessarily inhaled tion which rose from the water and mingled

In an article in Die Umschou, the substance of which is here presented, Dr. Bickel states that when water impregnated with radium emanation is ad-ministered internally the emanation remains longer in the system, and therefore produces more effect, if the water is taken after a full meal, than if it is taken on an empty stomach. In rheumatic and arthritic affections the remedial action of the water, thus administered, is greatly corroborated by baths, in which the bather finds opportunity for exercise, which is beneficial in itself and also accelerates the evolution and inhalation of the radium emanation which the bath contains.

only objection to the pure inhalation treatment as it has hitherto been applied, is the necessity of confining several patients together for an hour or sev-eral hours daily in an "emanatorium," or closed room, the air of which has been impregnated with radium emanation. The room cannot be ventilated wasting the precious emanation, and, although oxygen is continuously supplied and carbon dioxide absorbed, the atmosphere becomes unpleasantly and even injuriously contaminated.

Dr. Bickel has recently devised a portable apparatus for the continuous evolution and inhalation of radium ation, which enables the patient to take the inhalation treatment at home. As the accompany illustration shows, the patient inhales air from a large bottle b, into which water containing radium emai tion falls in drops from a smaller bottle a, through a valve by which the flow can be regulated. The stion mask is so constructed that the patient can exhale either directly into the air of the room or into a third bottle c, the air in which contains the same percentage of emanation as the air in b, thus reproducing exactly the conditions of the "emanatorium, in regard to emanation pressure.

in regard to emanation pressure. Except in special cases, Dr. Bickel recommends the administration of radium emanation through the stomach and the fungs conjointly, and he adds the bath tristment in some cases, as indicated above. When the baths are omitted, by prescribes a glass of strong consents of the constantion water, taken after a heavy breakfast, and followed immediately by one or two hours' inhalation with the apparatus described.

Common Defects in Metal Alloys*

Common Defects in Metal Alloys*
THEM howeldge of the properties of non-ferrous
E testain and alloys has not dravinged as fast as
that of from and steel. Several causes have con-tributed to profite this condition. The number of
influencial metals and alloys is no large, and that
therefore the representation of the properties of expects of the series and their
chargestant of the several date provided to of
little or air value when applied to another. A consideration of the derival detects which occur for com-monstration of the derival detects which occur for com-

per read by Dr. C. H. Desch before the Institute of Metals. In view of the very considerable interest oot, we reproduce here Dr. Desch's words:

"Many difficulties are met with when using alloys in practice. Some of these are inherent, but some could be avoided by careful treatment. It frequently happens that a perfectly satisfactory alloy fails because of being subjected to entirely unreasonable heat treatment or to mechanical stresses, in the course of being fitted for use. Such treatment is applied in ignorance of the effect likely to be produced, but considering the care that is taken in handling steel, it is remarkable that non-ferrous alloys are often treated as if they were mere inert material, which might be ill-treated without suffering any injury. For instance, while no user of metals would quench steel from high temperature or submit it to prolonged annealing without reference to the purpose for which it was to be used, it not an uncommon experience to find bronzes made for special purposes treated in such a way.

"There are eight distinct classes of defects commonly found in alloys used in machine building. These defects may be classified as: 1. Sponginess. 2. Brittleness. 3. Defects due to inequalities of composition. 4. Excessively coarse structure, due to casting at too high a temperature. 5. Defects due to wrong thermal treatment. 6. Defects due to molecular change other than that produced by mechanical stress age cracks. 8. Defects due to mechanical deforma-

Sponginess.—This is caused by gases dissolved in the molten metal or alloy, which are released at the moment of solidification This defect is aggravated by overheating the metal, and may be remedied by melting it and pouring it at the proper temperature.
"2. Brittleness.—This may be caused by oxides or



A RADIUM INHALER

dross due to lack of care in pouring, or to over heating, which causes burning, as in the case of the zinc alloys. The oxides of different metals vary as to their ability to separate themselves from the liquid and rise to the surface, and various deoxidizers are used to facilitate their removal in the form of sias.

A second source of brittleness is the presence of thin layers of non-homos ous alloys between the crystals The microscope is of great assistance in studying cases of this kind

"8. Defects due to inequalities of composition These defects are due either to improper mixing of the ingredients, to separation by gravity during solidification, or to engregation in the mold. When the ents are not uniformly mixed, the usual cause ingredi in the difference in specific gravity of the ingredients. Aluminium, for example, tends to float, and lead to sink. Certain metals, particularly aluminium, also possess the property of becoming inclosed in a film of oxide as soon as in the molten state, while others have an action similar to that of oil and water and must be stirred to an emulsion and then carefully cooled to prevent separation. With alloys of tin and antimony, or mixtures containing them, a difficulty is met with in that crystals of tin and antimony form and float upward. This tendency is overcome by rapid chilling. Impurities in general, such as lead and bigmuth in brugges, will accumulate at the center of the parts and sauce uncound castings.

"4. Excessively course structure due to centing at too high a temperature.—As the strength of an alloy depends upon the degree of adhesion between neigh-horing crystalis, as well as upon their size, and as

these qualities in turn depend on the casting temperature and the degree of chilling, this becomes a complex question that requires much further investigation. A few alloys containing copper and zinc, and especially those rich in zinc, have an extraordinary tendency to form large crystals having little mutual adhesion.

"5. Defects due to wrong thermal treatment -These defects are due to a number of causes, as, for instance, to quenching from too high a temperature; stance, to quencing from too night a temperature, heating at too high a temperature or too long during annealing; burning, as in the case of copper and zinc alloys; and unequal thermal treatment of different parts of the same casting and forging. The principal effect of wrong thermal treatment is the production The principal of coarse structure in alloys in general, and a hard, brittle metal in most bronzes Unequal treatment also produces differences in the structure in different parts

Defects due to molecular changes other than those produced by mechanical stresses—Some metals undergo changes at definite temperatures which involve a complete alteration of their properties The most striking instance is that of tin, which may pass spon-taneously into a gray powdery substance devoid of mechanical strength, at a low temperature Many alloys have been known to disintegrate spontaneously from no known cause Some of the alloys of alu-minium with other metals fall to powder after a time, while an alloy of 80 per cent of aluminium and 20 per cent of tin breaks up into coarse crystals may be that these phenomena are due to impurities in the constituents. This is indicated by the behavior of alloys of copper and manganess which have been described as disintegrating spontaneously. When pradescribed as disintegrating spontaneously pared from pure metals, however, these alloys are manent, and the disintegration is entirely due to the presence of non-metallic impurities

Shrinkage cracks -These may be due to a poor arrangement of the mold, to wrong casting temperaturand to the great brittleness of the alloy at a tempera-ture just below that of solidification. The latter condition is the cause of the great tendency of aluminium zine castings to crack during cooling

"8. Defects due to molecular changes produced by mechanical deformation. - These defects show themselves as brittleness in cold worked metals; 'season cracks' in brass and other alloys which become visible some time after rolling, and 'fire-cracks,' which differ from the foregoing only in that they appear during the annealing process alone It is said that fire-crack new anneaing process alone it is said that fire-cracks never appear in pure metals, but always in alloys. German silver is particularly liable to this defect Chilling-cracks' are produced when metals are suddenly quenched. Cracking is also due to het workins. as most alloys show an increased brittleness at some particular temperature Many bronzes have only a small range of temperature within which they may be safely worked. This subject has as yet been but imperfectly investigated.

There are some defects which do not fall under any one of the above heads. These defects are due to corrosion and erosion. The question of corrosion is being investigated by a committee of the Institute of Metals (Great Britain) The conditions which affect the liability of alloys to mechanical erosion also demand further study. An interesting case of erosion is that of high-speed propellers acted upon by eddy currents in the water. In some cases the eller blades are eroded to a depth of as much as 1½ inches in the middle of a blade, while the remainder of the blade is perfect. It appears that different bronzes behave year differently in regard to this action. A definite relation between the micro-scopic structure and the liability to erosion yet remains to be established '

Magneton: A New Constituent of Matter

ELECTRICITY, which at one time was assumed to be a wave motion in the ether, is now regarded as a substance made up of atoms, or electrons, which exist in the atoms of all kinds of matter, and in a sense constitute the primordial elements of which all matter is composed. This view, suggested by the fact that the smallest quantity of electricity that can be measured (the quantity carried by a hydrogen atom in electrolysis) is always the same, is confirmed by the results of experiments in radio-activity. This elementary quantity of electricity is called an electron The same tendency toward the materialization of energetic concepts is shown in recent attempts to establish an atom of light, and the process is now being extended to magnetism. Pierre Weiss has submitted to Paris Academy of Sciences an essay, in which he attempts to prove, from the results of experiments on the magnetization of various elements at extremely low temperatures, that the atoms of iron, nickel, per, manganese and uranium contain definite quantities of an elementary magnetic substance, to which the name "magneton" is given.

Curiosities of Science and Invention

A Maori Warrior on Jade

HE New South Sea Island Hall which has recently been opened to the public at the Museum of Natural History, New York, contains one of the largest and most varied collections from the South Seas probably yer seen in this country. These specimens represent the ethnology, material culture, ceremonials, household arts, war clubs, weapons, im-plements of hunting and fishing, etc.., as used by the native inhabitants. The Fijian collection, numbering over 2,000 objects, is especially noteworthy and was presented as a gift by Mrs. Morris K. Jesup. One of the striking features of the exhibit is a unique statue represent-ing a dancing Maori posed on the largest boulder of jade in the world; the stone weighs 7,000 pounds. It came from West Island, New Zealand, and was presented to the Museum by Mr. J. Pierpont Morgan The statue was executed by Mr Sigurd Neandross, and was cast entire from a living Maori, the model being sprayed with paraffin, and plaster applied afterward to strengthen it. This is less painful than the old plaster process, and the entire head and body can be taken at one cast. The coloring was done from life, and the tattooing on the done from hips was copied from a series of tattooed heads forming a part of the New Zealand Exhibit. While performing a dance the Maori man must follow the traditional code handed down from his fighting ancestors, which demands a constant thrusting out of the tongue accom-panied by the greatest possible distortion of features The farther the tongue is protruded, the more terrible and dangerous is the man supposed to be to all foes. The Maori is pictured beating time to the dance by striking the palm of the hand against the thigh and brandishing aloft the favorite war weapon, the

Electrically-heated Fabrics

THE idea of using an electric heating wire in connection with flexible ma terial is not new, but as far as we are aware, it has been used with asbestos fabrics only Such fabrics are intended particularly for high temperatures. They are naturally of coarse grain, and were not very manageable electrically, and were also wanting in flexibility.

An inventor has recently hit upon a mothod of electrically heating carpets, coverlets, knitted fabrics and the like, made of wool or other threads, so that the presence of electric wires is not beirayed The wires are energized by a flexible cord attachment to a lamp socket. It is during the weaving process that the textile throads and the electric wires are put into the fabric together, and they go to make it up in such a way as to preserve the usual appearance and supple ness of the tissues A central wool thread is used around which a flat braided metal card is wound spirally. The flat braid is made up of very fine nickel wires, and after it is wound on the core thread, the whole is given an outer braiding of wool or other threads. Thus a very flexible thread is formed which does not buckle when it is woven. The metal thread has a large heating surface in proportion to its section. The great number of electrothermic wefts composing a circuit permits of having between two neighboring wefts a difference of less than one volt, and the fabric is arranged so that there is no danger of short-circuiting in this way, and there is nothing to be feared in using the fabrics. The selvage is not made with heating wires in order to avoid bringing the metal near the borders where it might become rubbed. Col-



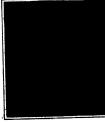
Statue of a Maori warrior at the American Museum of Natural History



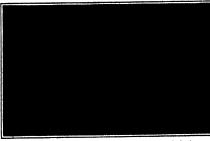
st tomb in England 200 feet high.



Coveriet kept warm electrically.



Electro-thermic pads for the bed.



Rugs woven with electro-thermic threads to give a warm underfooting.



in the selvages, and it only exacts a small connection pie dexible wire, which can be take plug in a wall souket as usual. Pure nickel is found the best wire to use, as when overheated its electric resis tance at once rises and outs down the current, so that an automatic regulating action is given which prevents overheat

The Tallost Tomb in Engis

N EAR the well known seaport of Bouthampton, England, there is a remarkable, adding known in Peterson's Tower. The wavelon is all the mere sin-gular because it marks the harring place of a certain John Petersen, a we tea planter. The man appears to have been rather an eccentric individual, and in order to prove to the world his belief in concrete as a building material, set about the construction of this great tow-er. The building took many years to complete, but is entirely of concrete, and by the time the final layers had been phaced had reached an altitude of more than three hundred feet. It is about forty years since the tower was erected, and its present condition is certainly a justification of the faith of the builder. As has been indicated, Petersen left in-structions that his remains should be placed under the tower, and this was accordingly carried out. Another desire that the chamber at the summit should contain a light was defeated by the firm tand which Trinity House, the light-house authority, took on the matter. Such an illumination would have been visible for miles out at sea and would aturally have proved very misleading

Combined Detector and Tuner for Wireless Telegraphy

T first glance one might be led to Ar first glance one might be led to believe that the instrument pictured herewith is an ordinary standard double nerewith is an ordinary standard double slide tuning coil. However, on closer ex-amination a detector may be plainly seen at D. The slider S is a common slider similar to that used on any standard tuner. It makes contact by means of a brass ball which rolls on the bared convolutions of the coil. Slider 8 has no ball, but has attached to the lower part a stiff spring H, which carries the regu-lating screw B. This screw bears on a lighter spring C, to which the detector is attached. The detector is a blunt piece of silicon embedded in a brass cup. and the silicon makes contact with the convolutions of the coil, which are bared along the path of the detector. Thus the bared copper convolutions act as the other element of the detector. By means of the screw B, the pressure of the silicon member upon the bared wire convo-lutions may be varied at will. Direct tutions may be varied at will. Direct tuning is accomplished simply by sliding the detector D back and forth until the point is found that gives the loudest

Of course the detector uses no bat teries of any kind, as the rectified current of the incoming waves is sufficient, as in the common thermo-electric detectors, to operate the telephone

Blasting With Compressed Air.—In modern mining the operators are ready and willing to avail themselves of any and willing to avail themselves of any new methods or devices which will cheapen and increases the production, and a method recently adopted it some con-unions disinders the sines of coal by the direct application, behind the sman, of a charge of compressed air. The method appears to be affective, and seems to have no videopast of dampes of the pro-ting on the behave.

The Inventor's Department

Simple Patent Law: Patent Office News: Inventions New and Interesting

er Wm. A. Cowles HEER must be some compensating element in life that will enable a man, almost a constant sufferer, to mainhappy exponent of good fellowship



Principal Examiner W. A. Cowles.

of the best kind, such as we find man! sted in Principal Examiner Willi Cowles of the United States Patent Office

completing his studies in civil engineer ing at the Sheffield Scientific School of Yale College, and a short tour of service with the City Surveyor of New Haven, he was appointed topographer on one of ne was appointed topographer on one of the parties of the United States Geo-graphical Survey west of the 100th meridian, serving under Lieut. George M. Wheeler, Corps of Engineering, U. S. A., and was engaged for a number of years in said service. Near the close of the season of 1877, while assisting in building a topographical monument on a peak of the Sierra Nevadas in California at the headwaters of the Carson River Mr. Cowles detached a small piece of sione, which unexpectedly and without warning caused the fall of an avalanche rock, which crashed down the side of the peak, carrying Mr Cowles with That he escaped with his life was a miracle. As it was, he suffered combelow the knee, with surgical aid no nearer than Genos, Nev., nearly 60 miles Thence he was carried over rough trails and mountain roads, and his legs could not be set until more than three days after the accident. After much surgical experience, until he was finally able to a Chicago hospital after months of treatment, he was obliged to learn to walk anew, and it was several years before he was able to abandon his orutches for the cane which is his con-

After a short service in the Land Office t Washington, he was appointed to the examining corps of the Patent Office, and serving through the grades, was ap-pelited Principal Examiner in June 1905. Me has always served in important divisions, and prior to his appointment as apal Examiner was assistant to the te George Reeley, to serve under whom gat be likened to a liberal education the craft. His classes in the office cluded trydraultos, electricity, and class of masoury, etc., now in his of His class at present includes the construction, of much importon, of much import-

And the second of the second o

rs constitute a prominent part.

only evidenced directly by the nature of actions issuing from his division, but by his assistants, who are so sought ience. An attorney who had been instru mental in securing the resignation of a number of his assistants for the purpose of accepting places outside of the office once told Mr. Cowles his loss of mer was his own fault, since his training and xample rendered his assistants desirable nen for important outside positions.

The Need of a New Assignees' Index in the Patent Office

HE statutes relating to assignment of patents provide that an nent, grant or conveyance shall be void against any subsequent purchaser or mortgagee for a valuable consideration without notice, unless it is recorded in tent Office within three months from the date thereof.

Under the present practice of the Pat ent Office, all transfers and assignment of the patent property of the country are indexed in the digest of assignments only under the name of the inventor of the invention, application or patent specific set forth in each instrument.

Prior to 1870 the Patent Office indexed instruments as in indexes relating to realty, that is to say, from party to party. However, as many intermediate links in the chains of titles were not ecorded, it was found that after the fallire to record any particular instrumen all trace of subsequent transfers would be lost in making searches To avoid this difficulty. Congress in 1870 made a special appropriation for the purpose of indexing all prior recorded deeds under date all assignments recorded have been indexed under the name of the inventor Therefore, in making title searches of patents, it is necessary to know the name of the inventor of the application or invention or patent involved, and the searches are made by examining the in-dexes throughout the entire series containing the name of the inventor of the particular application or patent which is being considered.

Frequently attorneys and the general public desire to ascertain what patents are owned by an individual, firm or cor-

to assignce. As during the period covering the life of a patent, to wit, seventeen the patent situation and one thousand volumes, it is very of the Patent Office presided over by Mr. difficult to make a reliable search and J. H. Colwell. This division handles report as to the patents owned by any also marine propulsion. Formerly the particular person, firm or corporation As a matter of fact, the term of seventeen years does not cover the possibilities of the case, since an assignment may be recorded many years before the patent

In view of the foregoing, the desirability of a consolidated assignees' index is apparent for the convenience of arching title for patent property when the name of the assignee only is known or when it is desired to know the patent holdings of any particular on, firm or corporation.

Of course the record of agglemments in the Patent Office is open, but the search required to ascertain the facts quire so much time, that they are rarely

An index of assignees would not only be useful directly in ascertaining the property holdings of any particular person, firm or corporation, but it would also be useful to attorneys as well as to the office in checking up results of an examination based on the index under the inventor's name, and in case of in-jury or destruction of one of these indexes, the other would be useful in trac ing patent titles, as will be apparent to those familiar with this class of searches

In addition to the value of the index of the character described to the general public, it would be useful to Bureau of Corporations in any effort instituted by that bureau to ascertain the property holdings of a patent character

f any given corporation.

The cost of establishing and maintaining an assignee's index would not be very great in proportion to the value of the index to the public generally.

J. H. Colwell

A 8 we survey the remarkable developpresent day, we hardly know which calls for our greater admiration, the wonderful perfection of the well-established arts or the rapid development of the new The latter perhaps more immediately poration, and there is no way in which strikes our attention, and attracts our to determine such fact, except to search interest. The opening up of a new field

ance and marked by much activity at each of the volumes wherein are recorded of invention necessarily brings with it this time, and cutlery, in which safety assignments, and in which volumes the a number of secondary consequences, assignments are indexed from assignor among others the necessity for providing the necessary facilities for coping with The new art of re are between nine hundred aviation has been assigned to the division

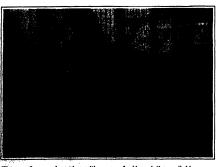


wo subjects were dealt with quite sen arately, but when airships employing propellers, especially those of the "heait was found that the class of aeronautics included practically no art as related to propellers, and much of such art was necessarily embraced in ship propulsion. Then the close analogy between ships for navigating one fluid, the air, and ships for navigating another fluid, water, became apparent, the relation between ships for propulsion through the air and submarine boats being very close, because they both are immersed in the medium they navigate The class having been as signed to Examiner Colwell, continued to grow with the very rapid increase of intorest in the art and one of the largest interferences in the history of the Patent Office was declared by Examiner Colwell shortly after he assumed charge of the

Mr. Colwell was born in Pennsylvania, and entered the United States Naval Academy in 1877, and after graduating in 1881, studied law and became an assistant examiner in the Patent Office, and was promoted in 1907 to the office of Principal Examiner. His classes in the Patent Office have included electrical signaling and telephony, and many other sub-classes, and his service in the Patent Office has been continuous since his appointment in 1889, except for a period during the Spanish war, when he resigned to accept a commission in the navy, serving on the U S S "Terror" off the coast of Cuba and Porto Rico. Commissioner Billings also resigned his position in the Patent Office to accept a commission in the navy during the panish war, both Messrs Billings and Colwell re-entering the Patent Office at

Making Aeroplane Wings Impervious

I N order to make the wings of aero-planes moisture proof and practically impervious to air, so that they will combine great supporting power with light weight, the fabric is impregnated with



Waterproofing aeroplant wings with a apray of rubber solution applied by mea of an air brush.

e of the whole distributed and the second

rubber. A new way of accomplishing this in a quick and easy manner has been put into practice in France, where agroniane manufacture has become ognized industry. After the thin, light fabric has been stitched together and fabric has been stituned together and stretched on a frame, a solution of rub ber contained in a portable tank is sprayed on the cloth by means of com-pressed air, as shown in the accompanypressed air, as shown in the accompany-ing photograph, taken in the Deperdusin factory in Paris. The compressed air is supplied by the electrically driven air compressor and tanks on the bogey, and passes through a long rubber tube to the solution tank and thence to the aprayer held in the hand of the operator. A second tube conveys the solution from the container to the nozzle, whence it is drawn and atomized by the current of compressed air passing across the nozzle. It is the same principle as that air brush which artists use. Railroad freight cars are now also painted in this same way with the most surprising ra-

Notes for Inventors

Interesting New Inventions. Among the interesting patents recently granted is the patent 990,869, to resi-dents of Antwerp, Beigium, for an electric switch operating device; 990,879, to an assignor of the Cooper Hewitt Electric Company for a tilting lamp, including a negative electrode of conducting liquid rein the device is started into opera tion by the rupture of a stream or layer of conducting liquid; 990,893, for a pilot-cell for electric storage batteries; 990,-897, for a flying machine having a me tallic gas container of generally rectan-gular form with its front end forming a lifting plane in connection with heli copters and operating means; 990,958, 990,966, 990,976, 990,985 and 991,038, for various inventions assigned to Westing-house Electric and Manufacturing Comnany: 991.012, to Gillette Safety Razor Company, assignor, of an apparatus fo hardening and tempering Patents 991, 105 to 991,114, inclusive, have been granted to William A. Turbayne of Lan-Y, assignor, for electric sys tems of distribution, except patent 991, tems of distribution, except patent 391. 113, which is for a charging apparatus. A patent, 991,804, has recently been granted to Schmidt, of Cincinnati, O., for what is termed an Easter rabbit, includ ing a casing which may be shaped as desired and a magazine in the casing from which egg-like objects may be dis charged, the invention being embodied in the patent in a rabbit-like figure whose tall may be pressed to eject the egg-like figures from the mouth of the figure. patent, 991,472, has been issued, for a climbing device having sections to re-ceive the foot of the user and sections to embrace a pole so that user of the device may walk up or down a pole as desired

The Water Monkey, -As summer approaches and the demand for cool drinks increases, it is well to consider some means of securing a palatable cold drink that will not only be free of the objections raised by many to iced drinks, but will also be economical. Those who have been on shipboard in the tropics will recall the water monkey, a porous jar filled with water and hung in a breeze so that evaporation from its surface would cod its contents. Now that elec-tric fans are universally used, it seems tric rans are universally used, it seems someone should invent a convenient, offective holder for a water bottle with wet cloths or some similar absorbent covering for the bottle to place in the range of an electric fan so that the lat ter would, by evaporating the water from around the bottle or other water holder cool the water to a pleasant temperature or drinking. This need not in any way detract from the primary purpose of the fan and the cooling device could be made entirely independent of the batte and of the bottle and adapted to receive any desired form of water-holding vasies.

RECENTLY PATRICTED INVESTIGATION These columns are open to all pulsation. The netices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the Scientific American.

DEVICE DRY PREVENTING HEARING.
NESS AND ALSO APPLICABLE TO LIPPS
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ON BOARD SHIP—H. BAUGALEM TO LIPPS
of the price a chiral suspendio device for the age
and stopping are affectably custioned or the
script, and the price and the price application of the
cage stationary in its support to allow or pasempere entering and leaving it conveniently,
a pawl and ratchet device for preventing the
underlied fall of the cage; and a simple form of
deterioid and other mechanism for controlling the working of the cagine.

Of Interest to Farmers

Of Interest to Farimers.

ADJISTABLE SHED CELL FOR PLANTREB.—A. M. CRIMAR, Davemport, Iowa. This
interation is an improvement in adjustable
seed cells and the object of the inventor is to
provide a plate baving means for adjusting
the size of the seed cell, wherein it will not
be necessary to change the seed plates for
seeds of different sizes.

seeds of different sizes.

BEAN HARVESTER.—JAMES R. FOWLESS
and MOREKLI. J. UPFORD, Amenia, N. D. The
invention illustrated herewith has reference to
a machine for harvesting beans and the like
and separating them from the stalks and charThe usual method of harvesting them is to



pull them by hand and pile them on the ground until ready for threshing. This rea-ders them lishle to be spolled by damposes and by mixing with dirt. The object, therefore, is to provide a device which will automatically pull the vines, thresh the beauts from the stalks, separate them from the chaff, and sack the separated beaus.

the separated beans.

MILKING SYNOL.—G. A. MALMOREN, Altkin, Minn. This stool is adapted to be readily
manipulated at the side of the nrinest to be
milked. The aim is to provide a device which
will be extremely simple in construction,
strong, readily adjustable, and with for corners and creviess to harber dirt and dust, so
that it will be perfectly sanitary.

CONNEWER, D. CONNEWER, D. Readule, N.

that it will be perfectly smilary.

CONVEYER,—J. OPERSMENT, Hosoluli, Bawall. The invention has for its purpose a conveyor in which the derrick cars are previded with appliances to stably and stationarily hold them during the loading operation, and shapt heavy loads to be carried to the cable without danger of the cars overturning or otherwise deranged or accidentally shifted.

SEGAR CAR CUITTING AND CRUSHING MACHING.—Panno A. PICON, Merida, Venewards, can be the control of the con



SUGAR CARE CUTTING AND CRUSHING MACHINE

vices a mechanism with means for separating the strips to deliver the same between the crushing rolls in flat position to present the pith in position to be crushed, the sits or shell being presented edgewise to the rolls to offer the minimum resistance to the crushing strein; and provides means for capturing the tities of

athis barrels, and has for view-ing of a mapper of barriel inself-rwe, which are juinted regarders tally sentent transvense seems, and and portion of such simples, in-med portion of such simples, in-ter and partly succeeding to the other section of the seems, FUERIGATING APPARATUR-Greenville, Miss. The object his

oks in tu

for securing the sectoraneous.

SHIP CLEANING DEVICE.—CRAELES

HOLLAND, Silko, Nev. This device is for use
cleaning the hulls of ships and other reset
by a process of scraping; in remeding burcles and other marine growths and the it
and the hevention has reference more parts



ot the CHAIRS.

DRIBE.—CLAUDIUS F. MERRITY, Inversess,
Fla. The purpose here is to produce a development of the produce a development of the produce and the properties, graphite, cement, and like materials, by passing the material through a substantially perpendicular take, provided at interrals





bello indicates tital: the project here has been obtained. If the bred is not in true, or it is cleared to have the level arranged at a gradual colorist to have the level arranged at a gradual resolution of the second to have been as the second to the se

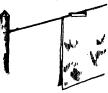
window, to hold the name stationary.
HOSE COULTAIN.—W. J. ROLLE, Oldschin,
Cal. This coupling is of a type adapted to
connect together two sections of any hose. An
object is to provide a device which will be
attachable and destabable in the shortest pos-sible time. A further object is to previde a
coupling comprising a pair of interitting
members having an efficient automatic packing
disposed therebottemen.

disposed thereteween.

ATTACHMENT FUB DOOR CLAMPS.

W. Lang, Chico, Cal. This attachment is in the manufacture of doors, sash, blinds. in the manufacture of doors, mach, hilled, sets, in clamping the various parts together, as the stifes and rails, and the purpose is to present appreciable friction between one of the part of the clamp and the door or similar piece of all works, so that the stiles and rails will be brought at exactly right-tangles to such other when the door is fully present tagether.

CLOTHER CLAMP.—John W. Firch, Bentonia, Miss., care of J. L. Simiar, Bentonia, Miss. The manner of using the change is shown herwith. The fabric having been applied to a line, the stamp is then fixed in the



position shows, by which the slot in the phrecives both the labels and the line. I edges of the phrise at the slot suggest and to the labels of the class, it cally used to easy to control to the labels of the class, it cally used to easy to control to the labels of th Plate





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(13461) J. E. P. says: Would you please explain to me why it is that the stars of a city are also effect of the stars is chiefly as effect produced in our atmosphere youn the waves of light. It is due to currents and strats of air of different densities interninging and fosting past each other. Indeed, which is light passes to the other indeed, which is light passes to the other indeed, and in the content past of the other indeed, and in the content past of (12461) J. E. P. says: Would you sities and in motion. Rapid twinkling stars is a sign of a change of weather.

The lane will be seen to wave and quiver. The lane will be seen to wave and quiver. The lane of the la

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CHICAGO U S A

The Heavens in June nued from page \$16.) (Cor

(Continued Free page 164)
northeramost stars of Centarurus. Ob-servers south of lattiude 38 degrees may at this time see the two height feater Alpha and Beta Centaert, low in the south. The former, which lies to the castward, is the nearest known star.
Scorpio is raing in the southeast, of the castward, is the nearest known star.
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Scorpio is raing in the southeast of the castward, is the southeast of the castward in the southeast of the castward is down in the northeast, Lyra shove it,

Serpens fill the southeastern sky. Cygnus is down in the northeast, Lyra above it, and then Heroules and Corona, on a line toward Arcturus. Cassiopeia is low in the north, Cephus above, then Draco and Ursa Minor, while the Great Bear is high in the northwest.

Cascella is setting below this, and

high in the northwest. Capella is setting below this, and Castor and Pollux are low down on the left. Lee is due west and higher up. Hydra stretches along the horizon from

Hydra stretches along the horizon from the west to the south.

The small sodiscal constellation Libra, illustrated in our initial, might be overlooked in such a hasty survey. It can, however, easily be picked out between Virgo and Scorpio. Jupiter, which is now near its western border, quite outshines its brightest stars, but two of them—Alpha and Best Libra—are above the third magnitude, and fairly conspicuous. The former is a wide double, which is a very pretty object for a field glass.

THE PLANETS.

THE PLANETS.

Mercury is a morning star in Aries and Taurus, and can be easily seen about the first of the month, when he rises about 3:45 A.M. Toward the and of June he is too nearly behind the Sun to be observable.

Venus is an evening star, setting about 10 P. M. all through the month, and very bright. Telescopically she shows the phase of the Moon just before third quartes on her way to become crescently and the star of the setting about 1 A. M. in the middle of the month.

Juntice is an State of the Leave of the control of the set of the set of the control of the set of the control of the set of

fix a defective magnetic and approxi-San Sebastian at 0.58 P. M., bay been 18½ hours on the way.

The third stage of the rece, a distance of 267 miles from San Sebastian to Madrid, was recod over in Thursday, May 26th, by Garro, Othert, and Vedrines. The first-mentioned of these avi-May 28th, by Garros, Githert, and Yed-rines. The first-mentioned of these evi-ators, who was racing with an Ameri-can monoplane built by Alfred 7.1 Motsant, was obliged to descend sift miles from 8an Sebastian owing to a breakdown of his Games motor. As he landed on the side of a mountain from which it was impossible to re-essrt, he was out of the race under the rules. Gibert was the first to start, leaving San Sebastian at 6:28 A. M. He was followed by Garros at 7:12 A. M., and by Vedrines at 7:17 A. M. Gibert and Vedrines passed over Toloes, shout 15 miles from the start, in safety. This place is in the heart of the mountains and at an elevation of about 4,000 fact. It was considered the most dimout part of the journey. Gibert descended at Olassquits, 40 miles from San Sebas-tian, to take on first and supplies. It attempting to re-earts, he machine up-to return to San Sebastian and to the help in making repairs. Vedrines few to return to San Sebastian and to get help in making repairs. Vedrines flew 125 miles, passing over the city of Burges at a height of 6,000 feet shortly before being forced to descend on ac-count of a breakdown of his Gnome motor. He managed to repair the motor, but did not finish the flight till motor, but did not finish the flight till the next day. On Friday he reasoneded at 5:20 A. M., and flew without a stop the balance of the distance to Madrid, reaching there finally at 5:09 A. M. His time was therefore 2½ hours for the 150 miles of the course remaining. He rose to 6,000 feet in crossing the Silera de la Guadararama Mountains, which are 4,750 feet high. He was greatly fatigued and most perished with the cold. Gibert also finished shortly after Vedrines.

Mars is morning star in Pieces, rismonth.

Jupiter is on the borders of Virgo and
Libra, and crosses the meridian at 9:40
on the 1st, and 7:40 on the 30th, so that
it is visible till the morning hours.

Saturn is in Aries, and rises about 3
A. M. in the middle of the mouth,
loranus is in Sagittarius, and is due
south about 2 A. M. Neptune is in
Gomini, ion ear the Sun to be observed.

De min to 19th, and her set 8 A. M. on
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and the 19th, and new set 8 A. M. on
the 28th, and farthest away on the 19th,
and farthest away of The Paris-Madrid Aerophane Race (Ontowed from pose 1843) at San Sebastian, and descending in a manifecting lide at 10:59. A fareachon he left Prance. When passing out forces of the passing out over the Bay of Blacay he encountered the worst air eddies with which he has sever had to deal. Near the Spanish town of Fuenterrabia one of his wings known of Fuenterrabia on the fuenterrabia one of his wings known of Fuenterrabia one of his wings known of Fuenterrabia in order to replentah his fat 28 horse-power, but developing in the He fuenter of Fuenterrabia in order to replentah his fat 28 horse-power, but developing in the He fuenter of Fuenterrabia of the fuenterrabia of the fuenter of Fuenterrabia of the fuenterrabia of the fuenter of Fuenterrabia of the fuenterabia of the fuenterrabia of the fuenterrabia of the fuenterrabia



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100 kilometers in 59:08, whereas carrying two passengers he required only 8 seconds more. Both these former records were made with a 50 horse-power Gnome motor.

Mones motor.

The Paris-Madrid race was organised by the Petit Paristen of Paris, the prize being \$30,000. In addition to this the being \$30,000. In addition to this the Bpaulah Aero Clubs added \$10,000, and King Alphonso offered a special prize for the machine which makes the fastest times over Spanish territory. Competitors in the race were also eligible for the Quentin-Bauchart prize of \$10,000, which is open for competition from the properties of the competition of the competitio

The Current Supplement

THE Helimann suspension for automobiles is the aubject of the opening article of the current Suprazarara, No. 1848.—It is generally recognized that improvements in aerial navigation will be greatly facilitated by a decrease in the weight of the machinery. With this end in view, metals or alloys of low specific gravity have been sought. The The increasing deman for rold as turned the attention of miners and metallurgists to now fields and new methods. The more notable of these are described by Elimer Elisworth Carcy, under the title, "The Electrolytic System of Amalganating Gold Greex"—Mr. W. L. R. Emmet contributes a paper on proposed applications of electric ship propulsion—New York of the Company of the Company of the Company, and the Company of the Company, shows what a financial asset research is to a large manufacturing company—Mr. Seabstrilc hosting contributes a paper on Diesel machine contributes a paper on Diesel machine contributes a paper on the contribute of the British May.—How a reinforced concrets building was demolished is described and illustrated —Mr. Willis R. Whitney, director of the Research Laboratory of the General Electric Company—Mr. Seabstrilch concludes his splendid paper on Diesel machine contributes of the May are a financial asset research is to a large manufacturing company—Mr. Seabstrilch concludes his splendid paper on Diesel machine in the mineral contributes of the May are advented to recent advances and problems in chemistry. The paper is printed in the current Suprexexer.

Queer Mountain Shadows

Queer Mountain Shadows
THE Peak of Tenriffe projects a laye
I hadow stretching upward of fity
miles across the deep, and partly eclips
ing the adjoining islands. Exaggerated
shadows of immense aits are commonly
sees in many other places. On the Hartz
mountains the so-called Spectre of the
Brocken throws gigantic shadows of
mountain cilimbers into the sky, repeating every movement made by them. The
same occurs on the summit of Pambamarca, in Peru.

On the level of Albira marks and on

On the tops of Alpine peaks, and on the summit of Ben Lomond, in Scotland, mists in one case and rarefied air in the other explain these optical illusions. The same causes produce also colored shadows, varying at each hour of the day, and traceable to the dispersion of the solar rays.

The Earth's Core

AT a meeting of the Seismological Association at The Hague, Frot. Welchert asserted that his studies of the varying velocity of eachtquake the special part of the spe

Australian Antaretic Expedition.—The American Association for the Advancement of Science has granted \$1,000 spears the proposed Australian Antagelic Expedition, under Dr. Mawson.



TRACE back your automobile difficulties and you will locate many of them in the cylinders.

Trace back cylinder troubles pounding, misfiring, etc.— and you will usually find a deposit of carbon.

Trace back the carbon deposit and you will find the fault in the lubricating oil.

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After several years of painstaking effort we have produced an oil that marks a distinct advance in gas engine lubrication.

This oil practically eliminates the most frequent cause of gas engine troubles — carbon deposit. The oil is called Polarine.

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Mayny

New Aviators at Belmont Park.—Most of the shock at Helmont Park are occupied at the present time the majority of them being filled with new acceptances in that course of construction some of which course of construction some of which can machine which have been making daily flights are the Queen monoplanes piloted by Arthur B Stone, who is a licensed aviator of the Aero Club of France This machine resembles the Biérot closely and has shown itself to be a sure and steady flyer. Two biplanes constructed by F P Schneider have been flown with success by the builder and his aviator Joseph Richiter On May 34th the latter made a 12-mile circuit across country with a passenger after he had mounted a new Roberts two-quie motor upon his machine Earl L. Ovington has also been making flights with his 70 horse-power Biériot.

Aviation Meets in America, "There was a general exodus of aviators from Mineola and Belimont Park last week brought about by important fying en gagements in various parts of the country Capt T A Baldwin packed up his new metal-constructed biplane and sent it. In Columbus Oble. lay Cap. I A Santrolla packet up his new metal-constructed biplans and sent of the columbus Chio, where a meet in the Columbus Chio, where a meet in the Chiombus Chio, where a meet in the Chiombus Chio ticipate with her humband in an aviation meet at Waitham, Mass., on June 15th Arrangements are now being completed and a fund of \$100 000 has been raised for a big aviation meet at Chicago from Angust 12th to 20th in addition to these meets Curitiss and the Wrighta are giving exhibitions continuously at variance of the content of the ous cities throughout the country

Recent Aeroplane Accidents.—Headed by the fatal accident at Issy les-Molineaux on Sunday May 21st (as mentioned elsewhere in this issue), there have been a number of more or less serious accidents number of more or less serious accidents with acropianes during the past couple of weeks. The same day that the French Minister of War was killed an acroplans fell upon the crowd of spectators at Odessa, Russia injuring a large number five of them fatally. Two days later, at Straburg Germany, Avistor Laemmin oil 200 feet and was instantly killed. On May 23rd also at Bristol, Punn, Anthony Jannus the young Washington sviator deliberately siteered his machine sharply to earth to avoid running into a crowd. He was thrown 100 feet or mage, but for-IN THE

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Recollections, Grave and Gay

By Mrs. Barton Harrison

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Science

Sir Ernest Shackleten's Arctic Plans.— In the columns of the New York Times, Sir Ernest Shackleton denies his inten-tion of leading an expedition to Crocker Land. He expresses himself pleased at the idea that the American Museum of Natural History, of New York, will send an expedition to Crocker Land.

an expedition to Crocker Land.

Dr. Samuel H. Sendder.—Dr. Samuel
H. Scudder died on May 17th, at Cambridge, Mass., at the age of 74 years. A
graduate of .../Illiams and of Harvard,
he was a custodian of the Beston Society
of Natural History from 1864 to 1870,
assistant Ibrarian at Harvard from 1879
to 1882, paleontologist of the United
Slasse Geologick. Survey from 1886 to
Bases Geologick. Survey from 1886 to
authority on Lepidopters. He was an
authority on Lepidopters, Rhopalocera,
Orthopters, and fossil Insects.

The Solar Poweller.—The scent next.

Orthopters, and fossil insects.

The Solar Pewsikes. The recent near approach of the small planet Eros to the earth afforded an opportunit, which was embraced by many satronomers, of making a new and accurate determination of the earth's distances from the sun. Arthur Hinke has reduced the observations, and has obtained for the solar parallax the value of 8.506 seconds of parallax the value of 8.506 seconds of 149.226,000 kitometers, or 92,725,802 miles. This value is probably more accurate than any previously obtained. It is somewhat smaller than the values given in most manuals of astronomy.

most manuals of astronomy.

Improving the Sugar Beet.—The question of improving the augar beet has come up in France, and many grovers were surprised to learn that according to recent figures France occupies only the fifth place as to the amount of sugar produced per acre of beets. It is evident that the quality needs to be improved, as Germany, Belgium, Austria and Holland are in the lead. Besides, the surerland are in the lead. Besides, the sugar industry finds it difficult to obtain a beet supply, as the growers prefer to sell to alcohol producers, and the sugar manufacturers cannot pay a high price, this being limited by the present low price of sugar.

of sugar.

Convering Light by Glass Rods.—There is a simple and insentous plan for conveying light to graduated circles at the point where they are to be read with the aid of an attached microscope. It is desirable not to bring the source of light meat the circles, on account of the heat, and so the light is sent through a solid and energy at the other. The light cannot escape from the sides of the rod owing to internal reflection, and score desirable cannot escape from the sides of the rod owing to internal reflection, and accordowing to internal reflection, and accord-ingly it is carried and delivered very much like water in a tube. Even when bent the glass rod does not lose its

charge. The Origin of Precious Orea.—Mon sometimes dream of enormous wealth stored deep in the earth, below the reach of miners, but experts aver that there is little or no ground to believe that valuable metallic deposits He very deep in the earth's cruet. Such deposits, it is said, are made by underground waters, against the earth's cruet. and owing to the pressure on the rock and owing to the pressure on the rocks at great depths, the waters are confined to a shell near the surface. With few exceptions, ore deposits become too lean to repay working below 3,000 feet. Nine mines in ten, taking the world as a whole, are poorer in the second thousand feet than in the first thousand, and poorer yet in the third thousand than in the second.

The Antiquity of Man.—It has been known during a long time that in Western Europe man existed during the glacial epoch. We now know that the great cent nurspe man existed during the gla-cial spoch. We now know that the great ice age consisted of different glacial times separated by interglacial times. In glacial times the snow line dropped 3,000 or 4,000 feet below its present level in the Alps, whereas in interglacial times it lay about 1,000 feet higher than at present. Thus the temperature seems to have been higher in the interglacial per-riode than it is now. There is abun-dant verdence, in the opinion of Fenci, that man existed during the beginning of the last glacial spoch. There is some reason for thinking that at least 20,000 Justice have been a super-tion, and that the ran whose jawbone issue found in 1900 1 ar Heidsburg lived

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The Railroads of a Continent

THE JUNE MAGAZINE MORNING OF THE SCHOOLSE AMERICAN ISSUE OF JUNE 174, 1611



Transportation facilities and civilization go side by side—a people's means for getting about give a prestly good line on their development in other regards. For this reason, among others, we are devoting the greater part of the June midmonth number of the Scientific American to the story of that marvelous network of railroads, which, during the past three-quarters of a century, has been woven over the face of the United States and Cart.

In bygone years, there was much cause for the fintility of the public to the

public unsists I but contributes have some changed for the butter. To dies' filipsis is no existent whyr the publics shad: the raisroads absuted not settle algorith lines in attitude of friendity conquestions. This at least, is the conviction of the Scientific American, and it is thread by Mr. Control C. Brown, Pusident of the New Yest Control and Idualges. Silver Railroad who will contribute a characteristically clear and forested article on this subject clear and forested article on this subject

Cas-ball of the railreads of the would are to be found in the United States, and, as usual, we have stateped our individuality strongly upon them. The most pictureous and remember between in our system is the half dozon great transcontinental routes, which them wonderful tretch of plain and mountain that lies between the Minintegri River and the Pacific. The story of the transcontinental roads will be teld by Mr. Wilson E. Hooper, Associate Editor of the Railway Age Genetic

Let it be understood that the above articles will be matter additional to the regular paper, which will contain the usual editorial, aviation, acteure abstracts, inventors and other weekly depart-

American Homes and Gardens

for JUNE

A SUMMER HOME AND ITS FURNISHINGS COMPLETE FOR \$1,000

In the June issue of American Horses and Gardens there will appear from the pen of the well-known author on House Furnishings and Decoration, Miss Alice M. Kellogs, an article, which tells how it is possible to obtain a summer home and its furnishings for the ridiculously small sum of \$1,000. That is not all. The article, which is fully distanted, shows how the house can be completely furnished, with the cost of each article. Would you believe that the amount named above includes the entire cost of furnishing? This is no fairy tale. The article specifies the aost of the house, and it also gives the exact cost of each piece of furnishing. This is no fairy tale. The article specifies the aost of the house, and it also gives the exact cost of each piece of furnishing currents. The article is profusely illustrated, so that the reader can judge for himself whether the parts described appeal to his particular tastes.

No family planning for an inexpensive summer outing should fail to seed for this interesting issue. No article has ever been published which provides for so much at so little expense. It deaks with facts and figures, and no come is better fitted to speak on the subject with greater authority that this expert. This issue also contains a large number of other articles on divers subjects, all of interest to the practical man or ,woman who is interested in country life in its broadest sense.

Copies of American Homes and Gardens can be purchased from the newstands and from the publishers. Price twenty-tive cents. Subscribe now for the year, and receive the thirteen issues, from July, 19]0, to July, 1911, for the full subscription price of \$3.00 for one year. Munn & Co., Iac., Publishers, 361 Broadways, New York, N.

Any one destring to order the full equipment described in the text of Mine Kallegy's article can do so by addressing the Editor of American Homes and Gardens at the above address. These still be no charge made for attending to such orders,

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and diagrams, readers this week easily the best and the most model, presides and complete that has ever hom contributed

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COL GEORGE WASHINGTON GOSTBALS, CANAL BUILDER. - [See page 567.]

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SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, JUNE 10, 1911 Published by Munn & Co Incorporated Charles Allen Munn. F Frederick Converse Beach, Secretary and Trassurer, all at 361 Broadway New York

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Munn & Co., Inc., 361 Broadway, New York The Editor is always glad to receive for examination illustrated articles on subsets of timely interest. If the photographs are shorp, the articles short, and the facts authent, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

National Archives in Danger

F it were to be shown that the national archives of the United States, including the original Declaration of Independence and the Constitution, were in danger of destruction, and that they could be reasonably protected by the expenditure of a sum of ten thousand dollars, one would think that no time would be lost in taking this very economical step for their protection.

It is a fact that not merely these priceless documents, but a large collection of others of scarcely less value, are at present arranged on wooden shelves, in wooden wall-cases, at the Department of State, where in case of a fire, they might quickly share the fate of the State documents in the recent fire at the Capitol at Albany, and be wiped out

It is also true that in spite of the fact that the peril of these documents has over and over again been brought to the attention of Congress, and reiterated requests have been made for the petty appropriation which is necessary for their protection, the National Legislature thus far has done nothing.

The truth regarding this matter, whose seriousness can scarcely be overestimated, was brought to public attention in a recent issue of the New York Times, which journal, in view of the unique character of the records, cannot be far from the truth in designating them as "the most wonderful and most valuable collection of documents in all the world."

Can it be otherwise when it includes, in addition to the original document of the Declaration of Independence and of the Constitution of the United States, the following original records: The Articles of Confederation of the Colonies, and all the other papers relating to the formation of the Government. series of bound volumes of the laws of the United States, including all the bills passed by Congress and signed by the President since the beginning of the Government, the original documents of the treaties of the United States, 559 in number, among which is included the treaty of peace made with England at the close of the War of the Revolution; thirty volumes of the records and papers of the Continental Congress, a number of volumes of papers of Franklin, relating to foreign affairs, etc.

The appropriation of ten thousand dollars will serve to repl see the wooden wall-cases with cases of steel, made as nearly fire-proof as possible.

These will serve to give the records a certain measure of safety until the completion of the new building which the State Department will occupy in four or five years' time, in which will be a fire and burglarproof vault, built specially for the safe keeping of this invaluable national heritage.

In safeguarding against fire risk, would it not be well to safeguard future records of this kind against that other destroying agent, the slow hand of time? The Declaration of Independence is alof time? The Declaration of Independence is already all but lilegible. If pure linen and a pure carbon ink were used, the result would be practically indestructible. This suggestion was made by Dr. William J. Manning of the Gevernment Printing Office, in an article published in the SCENTIFIC AMERICAN of June 6th, 1908, which will well repay careful consideration at the present time.

Serious but not Alermine

HE volcanic nature of the geological forma-tion of the range of hills through which the great Culebra cut is being excavated is causing our army engineers at the Isthmus a great deal of trouble, and is adding a considerable sum to the cost of the Panama Canal. When the French, under De Lesseps, some twenty-five years ago com-menced to bite their way into the Culebra divide unenced to bite their way into the Culebra cirriae, they were at once confronted with the delay and expense involved in the siliding of the hillside into the excavated cut. The material which moved down was composed mainly of the mass of elay which overlaid the surface of the slopes, and it was also the belief the belief of the French, as it was also the belief of our American engineers at a later date, that when the cutting had been carried down to the firmer, underlying rock, there would be no further trouble from this source.

Unfortunately, the rock has proved to be so hadly fissured and generally of such an unstable character that it has refused to hold the angle of slope at which the canal is being cut. As the excavarum-has gone down, huge masses of material, many acres in extent, have started to silde, generally upon some underlying stratup where friction was unequal to the task of holding the superfluembent weight against the pull of gravity. The Culebra which the canal is being cut. As the excar unequal to the task of holding the superincumbent weight against the pull of gravity. The Culebra cut extends for a distance of about nine miles, and at present over a score of alides are in motion, more than one-half of these being of considerable size.

Over one-fourth of the total length of the cut shows evidence of instability, and is either moving or liable to move before the work is done.

The largest of the slides, if we take account of its area, is the one at Cucaracha, which already has a total surface area of about 50 acres. This is the slide which caused the French so much trouble Since American occupation, over two million cubic yards have been removed, and there is a possibility yards have been removed, and there is a possioning that another two million cubic yards must be handled before the slope has reached an angle of repose. Near Gold Hill are two other slides, with a total area of about 35 acres, from which three million cubic yards have already been taken, and where at least another two million cubic yards must

As the cut is carried down to its final depth, conditions will, of course, be aggravated. Other slides will start, and existing slides will reach farther up the slopes of the hillside. It is impossible to predict to what magnitude the present m ments may ultimately attain as the cut is carried ments may ultimately attain as the cut is carried down to grade; and there is, of course, some possi-bility that portions of the cut which are now stable will ultimately give way. By the present methods of excavation and removal by steam shovel and work train, the cost of getting rid of the slides is about 30 cents a cubic yard. Colonel Goethals, in estimating the cost of completing the canal, made a liberal allowance-if we remember rightly, about six million dollars-for the removal of slid

The problem presented is serious, but not alarming; although the fact that the pressure from the sides has in some cases caused the rock at the bottom of the cut to bulge upward, comes pretty near to being alarming. The trouble will be mitinear to being alarming. The trouble will be mit-gated, in all probability, by impounding the water at Gatun as early as possible, and so flooding the Culcbra cut. The pressure of the water will tend to preserve equilibrium. Moreover, it will then be possible to remove the slides by floating dredges, at a cost, for loose material, about one-third of the present cost. There is nothing for it but to keep removing the sildes as they come in. It is not probable that they will delay the completion of the canal, although floating dredges may have to be maintained in the Culebra cut for some time after the opening of the canal.

The Science of Breeding Better Men

DA JUKE is known to anthropologists as the "mother of criminals." From her there A the mother of criminats, rrow were directly descended one thousand two hundred persons. Of these, one thousand were hundred persons. criminals, paupers, inebriates, insane, or on the streets. That heritage of crime, disease, inefficiency and immorality cost the State of New York about a million and a quarter dollars for maintenance directly. What the indirect less was in property stolen, in injury to life and limb, no one can retimate

Suppose that Ada Juke or her immediate children

had been prevented from perpetuating the Julie family. Not only would the State have been spared family. Not only would the State have been spaced the necessity of supporting one thousand defective persons, so-cally and physically incapable of per-forming the functions of citizenship, but American manhood would have been considerably better off and society would have been free from at least.

Instances such as these are not isolated. Ever since the late Sir Francis Galton gave us his science of Eugenics, which in its most literal sense means "good breeding," the scientific students of mankind, the directors of insane asylums and hospitals, criminelogists the world over, have been compiling statistics to show not only the danger of permitting the marriage of criminals, lunatics, and the physically unfit, but the effect upon makind. Thus, Prof. Karl Pearson, Galton's ablest disciple, has driven home the necessity of the scientifies study of the human race in many a telling statistical com-parison and monograph. He has shown that in Great Britain 20 per cent of the population (and that the understable element in England) is pro-ducing 50 per cent of English children, and that if

ducing 50 per cent of English children, and that if this goes on unchecked, national deterioration and degeneracy must inevitably result. Galton originally worked only with statistics, and in his capable hands, they proved a powerful weapon. After he had enunciated the principles of Eugenics, Mendel's law of heredity was re-vived and applied to the problem. Imperfectly understood as that law may be as yet, nevertheless it enables us to propheny with possidorship accuracy what the offspring of animals, plants and human beings may be, not only in the next generation, but to generations to come. Mendelian principles have no doubt long been followed by professional animal breeders in an empirical way, but only within recent years have enough data been accumulated to show that they apply with equal force to human beings. We know enough about the laws of heredity, we have enough statistics from insane asylums and prisons, we have enough genealogies, to show that, although we may not be able directly to improve the human race as we improve the breed of guinea pigs, rabbits or cows, because of the rebellious of mankind, yet the time because pigs, rations of cows, because of the resembas spirit of mankind, yet the time has come when the law-maker should join hands with the scientist, and at least check the propagation of the unfit. Prizes have been offered to crack trotters for beating their own record, \$10,000 for a fifth of a second, all for the purpose of evolving a precious two-minute horse. Yet we hear of no prises which are offered for that tet we near of no prises which are offered for that much worthire object, the physically and intellectually perfect man. Fortunately the need of intelligent legislation on the subject is being driven home by scientific men and Eugenic associations here and abroad. The Eugenica laboratory founded by Sir Francis Galton and the American Breeders' Association have done much to clear away the popular prejudices inevitably encountered in such educational work and to prepare the ground for legislative action. Some States have already passed laws that show an appreciation of the situation.

The proper attitude to be taken toward the per-petuation of poor types is that which has been attributed to Huxley. "We are sorry for you," he is reported to have said; "we will do our best for

is reported to have said; "we will do our best for you (and in so doing we elevate ourselves, since mercy bleases him that gives and him that takes), but we deny you the right to parentage. You may live, but you must not propagate."

The abaurdity of legislation to cure social evils without scientific facts to bese that legislation upon, is no more apparent than in the disposal of the insane. In Wethams's "Earnily and the Nation," it is stated: "According to the mid-Victorian concept, aman was either anno or insane.—nult made or coma man was either same or insane—quite mad or com-pletely cured. How he became mad, how com-pletely he was cured, were not taken into considera-

pletely he was cured, were not taken into consideration." It is not enough to take are of an insane
man. To discharge hims after a period of a few
months or a few years and brand him as cured,
when his whole family history points to the fact
that he is a hereditary epiloptic or lunatic, and to
place no barriers in his path when he attempts to
marry, is statesmenshly of the poorest order.

If the Eugeniat has his way, "well-born" will
acquire a new measing, It will not cease to mean
descent from a proud and noble race that has accounplished great things in the past, but it will also
mean that the stock descended from that race is
outposed of men and women who will live up to
its traditions, who will have that perfect physique
and stable mental organization which 'singuisty,
that most literary and hidseophical of psychiatrius,
calls "the highest sanity."

The Paris-Rome-Turin Aeroplane Race

Description of the First Two Stages of the First Great European Circuit

College a week after the dissectous inauguration with the property of the first and th

and Plan. "In the last stage the aviators expect to retirect their course up intrough the central; part of Rahy and around to Turin ois Fronces and Belegin. The distance in this gight is \$30 kilometers (\$31 miles). The start was made under parfect weather conditions at A. M. on the morning of Sunday, May 18th. Of the twenty-one com-

notifians twelve were on hand at the start and were despatched within an hour. Vedrines had not returned from Madrid and was consequently unable to start on Sunday. M. Reland Garros, who raced Vedrines with such vigor in the Paris-Madrid contest, was the first to cross the line at Buc. He was closely followed by Lieut. Connesu, who was in the other race, flew under the name of André Beaumont. Both aviators use Bisriot monoplanes. The latter passed th former and covered the 645 kilometers (401 miles) to Avignon in 12% hours, as against pure and 85 minutes required by Garros. Lieut. Conneau passed Garros on the way to Dijon (160 miles) and arrived there at 11:21 A. M., having covered the distance in 5 hours and 19 minutes. Garros arrived at 11:40 A. M., after having required 5 hours and 40 minutes to cover the 160 miles. The next stop—Lyons (105 miles from Diion)—was reached by Conneau at 3 28 P. M. After re-starting he finally a Avignon, 401 miles from Buc, at 6:47 P. M Garros, as above stated, arrived somewhat later. Most of the other competitors met with mishaps and "broke wood," as the extion is in aviation. M. Henri Molla, on a Bieriot monoplane, and Herr Frey, on a Morane monoplane, finally reached Dijon shout 7 P. M. The American aviator, Wey on his Nieuport monoplane, was especially unlucky. After two stops because of engine trouble he was forced to descend in a field near Troyes. The propeller was broken and the machine was damaged, but he was not injured.

The second day of the race the leaders were unable to make more than 220 kilometers (128 miles) on account of bad weather and many minor mishaps. Lieut Conneces was the first by arrive at Nice, where he evopoyed down from the clouds at 7:39 P. 28°, follered half an hour later by Garron. The former half-seen compelled to despend at one of the small towns sear Nice. Walle he was "selling his fuel tennis darres passed overhedd. Conneces immediately darres passed overhedd. Conneces immediately darres passed overhedd.

clares passed overheld. Conneau immediately district sally jumped into the passed overheld. Conneau immediately support of in the testh of a hindrig rainstorm. Meanwhile Garrier lost his way and was forced to descend the conneau managed to locate Nice and land other with the conneau managed to locate Nice and land the surfaced Lorsas at 1-14. Kinnereling arrived at Dijon at 5:55 A. M. Tad best there at 6:05. He arrived at Lorsas at 1-15 and left there at 6:05. He arrived at Lorsas at 1-15 and left there at 8:05 R. M. E had a lively reas with Frey to Arrived where Frey arrived in 3:56 and 1 and left there at 8:05 R. M. Kinner-ling land gained 15 minutes in what 10-onlie flight, as a large of 10 minutes from the German valuer. At 5:05 R. M. Kinner-ling, hadding the German valuer. At 5:05 R. M. Kinner-ling, holding the place in the reas with official of I'lling at Briganes concount of minute simplic complete (I'lling at Briganes, as he reas with official to 10 minutes of 10 minutes of

from Buc Monday morning at 9:02 A. M. Lieut. Conseau had notor trouble at Brignoise and was obliged to descend. He resumed his flight at 2:46 P. M. and indeed at Frejos cer outs. When he reached Nice he was at a great clevation, and, hearing some cannon shots and spying a fire in the center of the aerodrome, he was able to locate the latter and descend from the beavy slan to loud. He reported terrific and violent wind gusts at Freins, where he was not considered the service of capaciting. He was flying at from 4.500 to 8.000 of combining the wind, and he was obliged to descend he combating the wind, and he was obliged to descend immediately and make repairs.



Lieut. Conneau of the French navy, who reached Rome first in his Blériot monoplane. He covered 900 miles in four days.



Roland Garros, who arrived at Rome only an hour and

Note the map holder and revolution indicator back of the hood of the monoplane.

THE LEADING AVIATORS IN THE PARIS-ROME-TURIN
ARROPLANE RACE

Signor Mannisero, broke the guys of his Bildrid; when making has landing at Avallon, in the Department of Youne. He attempted to repair his machine and resume his fight. Molla, between Dijon and Lyons, passed through a torrential downpour of rain which forced him to descend at Barbieny, near Chalons-sur-Saons. He started again half an hour later, but was enveloped in dense vapor caused by the brilliant sumaline after the rain. He struggied through the fog and finally made a violent descent on the race course at Villeurhanne, near Lyons. He was unburt, sithough the wings of the machine were broken. Molla immediately attempted to repair his machine.

Garros also had difficulty in his trip from Avignos to Nice. He fell near Penns with a heavy shock. The gry wires of his Blefeic were broken and the wings damaged, but Garros managed to procure another machine and resumed his flight at 3:16 P. M. The third day'd the race, May 30th, Garros was the

The third day of the race, May 30th, Garros was the lucky aviator. He succeeded in reaching Pisa by nightfall, while Councau met with a number of mishaps and was finally stalled at Alassio, midway between Nice and Genoa. Five proched Genos shortly after 5:00 P. M. He left Avignon at 5:31 A. M. and made an excellent fight to Nice. He continued on immediately and succeeded in reaching the Italian city. Lieut. Connasu spent most of the morning tinkering with his motor at Nice. He finally set out descend at Alassio. He left Alassio in a violent wind, but after traveling a few miles only, he turned back and remained over night. Kimmerling remained at Hignoles most of the day endeavoiring to get a satisfactory machine. He tried a new one and sent for two more to Lyons Vidata rarrived at

Avignon after wandering far from his course. Bathiat, on a Sommer monoplane, was obliged to stop at Frolois, near Dijon, on account of a storm Weymann abandoned the rare

Garros's flight from Nice to Genoa was a continuous ovation. He was saluted by bugles, cheers, and cannon shots, and when he reached Genoa the enthusiasm of the people was almost indescribable. The same was the case when he landed on the estato of the King, the Casine di San Rossore, at Plas. The Frenchman was almost suffocated by the people, who covered him with flowers and carried him off on their shoulders in riumph. He said that he had experienced extremely stormy weather and had several times been in danger of capstaing. His physical condition after the long fight heread to be good to the first the entered to be good.

morning of the fourth day, May 31st, Lieut Conneau arrived at Genoa at 6:50 A M. After breakfasting, he started at once for Pisa. Flying over the Gulf of Genoa, he overtook and passed the warship "Victor Emmanuel," whose crew saluted whose crew saluted He arrived at Pisa at 9 10 without a mishap, but mistook the race course for the King's estate, and made a bad landing, hitting some of the hurdles At 12 55, however, he had finished the repairs on his maand was on his way to Rome Civita Vecchia he passed Garros, who was stuck there with a damaged machine He arrived at Rome exactly three hours after he left Pisa All Rome awaited him, and the telescopes in the Vatican observatory were the first to pick him out. He received a tremendous ovation, being picked up by the people and placed in an automobile beside the Mayor and the Prefect of Rome amid great cheering. The people even pushed the automobile along the streets. After delivering his message from the President of the Municipality of Paris to Mayor Nathan of Rome, Conneau was overcome with emotion

M Garros secured an early start from Pisa, but at Civits Vecchia he met with a mishap, when only forty miles from Rome. The machine was frying at a tremendous pace when it suddenly dove to the ground and was hadly wrecked. He finally succeeded in repairing it, and he reached the Etrenal-City at 5:30 P M
Herr Frey reached Pisa early in the morning, but wrecked his machine when alighting on the race track instead of the field where

alighting on the race track instead of the field where it was expected be would land. Lieut Chevran, who was one of the officers detailed to make the first stage of the flight from Paris to Nice, came to grief at Culsery, near Lyoga. He returned to that city in an automobile to serue new paris for his machine Lieut. Lucca, who was flying with a passonger, reached Lyons in the morning of the fourth day, after covering 135 miles, it is said, at 74½ miles an hour The fifth day, June 1st, M. Vidart few from Nice

The fifth day, June 1st, M. Vidart few from Nice to Genoa in a trife over three hours He continued on to Pisa, which he reached without mishap From Pisa he forged shead toward Rome, but was compelled to land at Cecina, after traveling only 35 miles. The left wing of his machine was broken in allighting. He was not hurt, but was obliged to return to Pisa for a new machine, which he hoped to procure in time to finish his flight to Rome on June 3rd Kimmerling collided with a tree just as he was leaving Brigmoles for Nice in the early evening of the fifth day. His machine was damaged and it is probable

(Continued on page 578.)

Waterspouts

Facts and Fictions Concerning Them

In the waterspout the medieval mariner saw a malevolent living monster—a "sea dragon."

El Masudi, writing in 964 A D., thus records the beliefs current in his day: "There are Timmins (dragons) in the Atlantic seas. Some believe this is a wind arising in a whirling column from the bottom of the sea. Some say it is a black serpent rising in

the air, and succeeded by a terrible wind; some say that it is a terrible animal living in the bottom of the sea, some say they of the sea, some say they are black serpents, passing from the desert into the sea, and living five hundred years. Abbu Abbas says they are killed in the clouds by cold and rain."

There were various means of combating them. Once all sailors carried black-handled knives, which the monster was believed to hold in special abhorrence. When a spout made its appearance these knives were pro-duced and pointed in its direction, waved in the air so as to make the sign of the cross, or, ac cording to the recom-mendation of certain contemporary authorities, driven several times into the side of the ship tain passages from the Gospel of St John were recited as charms against waterspours A loud noise of any kind was also

believed to be efficacious against them; shouts, the believed to be emcarious against them; shouts, the clash of swords, the beating of drums and gongs, etc. The custom of firing cannon against waterspouts dates back at least as far as the sixteenth century, as it is alluded to by Campens, in the "Lusiad" (1572). The original idea appears to have been to frighten them away by the noise of the report; but in later times it was believed that the watery column could be cut in twain by the cannon ball, and the spout thus dissipated. It would be interesting to know whether the cannonading of waterspouts is still sometimes practised. It was certainly common much less than a contury ago It is hardly necessary to say that it is entirely futile.

Many misconceptions concerning waterspouts are still widely prevalent, and these are kept alive by the loose and inaccurate statements to be found in many professedly authoritative scientific works that touch upon this subject. For example, one commonly meets with the statement that the waterspout (like its terrestrial congener, the tornado) is precisely analogous to the widespread cyclone, or "low," on the one hand, and to the tiny whirl of dust, dry leaves, and the like over hot dry ground, on the other. This statement is misleading. All three phenomena are, to be sure,



Waterspouts off the coast of New South Wales.

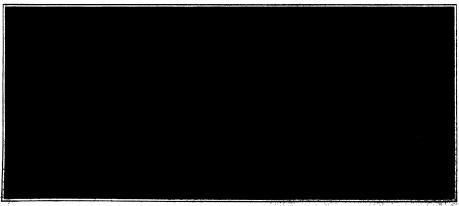
vortices in the atmosphere, and inequalities of temperature are their primary cause; but the immediate forces at work in producing them are quite different. The great cyclones of middle latitudes of winds revolving around centers of low barometric pressure, and extending over areas of hundreds or thousands of square miles—are episodes in the east-ward whirls of the whole atmosphere around the poles of the earth, and are evidently not due to ex-cessive heating of the ground beneath them, since they are more frequent and more intense in winter than in summer. Just how they are produce maintained is one of the great most questions of physics and meteorology. On the other hand, the little whirls so often seen on a dusty road, for example, result from an unstable condition of the air immediately over the ground. On a warm sunny day the ground becomes intensely hot, and heats the

whole is transuit, this particular point it se of gravity, above the colder and dens

at the convergent, and a pentral whirl or vortex is the result. In a cyclone the rotation of the wind around the vortex is always from right to left in the north ern hemisphere, and sice versa in the southern, be cause the inflowing cur-rents are deflected in a constant direction by the rotation of the earth. In the dust whirl the paths of the air currents are so short that the deflective effect of the earth's rotais insignificant comparison with the local effects of topography, etc., and hence these whirls turn sometimes to the right and sometimes to

the left, in the same hemisphere. From the foregoing paragraph it will be seen that the dust whirl and the cyclone are by no means identical phenomena, differing only in magnitude. What shall we say of apout

The latter term includes waterspouts, is and tornadoes In French they are all called trombes (from the Italian trombs, a trumpet, or the Spanish trombo, a top, in allusion to their visible form). There is no essential difference between the waterspout and the landspout; in both the visible "spout is a mass of water vapor, the condensation of which is due to the expansion of moist air under the diminished pressure within a vortex in the atmosphere; but in the landspout this vapor is mingled with dust and other terrestrial objects sucked up by the spout from the surface over which it passes.

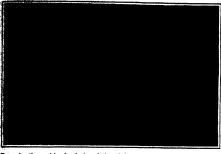


· A group of waterspouts on the Medit

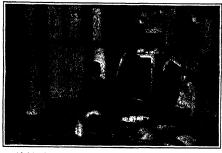
"Mad Dogs" and Hydrophobia

Rabies Before and After Pasteur

By John B. Huber, A.M., M.D.



Preparing the emulsion for the inoculation of sheep to be immunized against rables.



Administering the Pasteur treatment at the New York Pasteur Institute.

N order to appreciate justly the mighty is (though alient and bloodless) revolution that had its inception in the genius of Pastetti, one must compare the human sat-fertiage endured through the avarages of discussed which he demonstrated to be preventable with the alleviation of such suffering that has been achieved since his day. All the words great recurrence—smallpox, all the words great recurrence—smallpox electers, bubonic piague, malaria, yellow town, toberculosis, meningtia, diphibria—her wonderfully have their terrors been mitgated, how ovivous is it now that such diseases can be eliminated from human experience if the pilier of fire that has been reliased by the science of Pastetr and Koch should be but used assigned.

Rables, or hydrophobie, is one of these infections—and among the most dreadfulbecause of the intensity of its symptoms. However, as compared with other lils to which man its subject, it has fortunately been rare in human experience. On this account it has been given rather less attention than those diseases which have in the past decinated cities and wiped whole towns and vitlages out of extreme. And yet a consideration of hydrophobia is, apart from its tragic features, of peculiar interest, since it was the first disease upon which Parisur worked, in the evolution of the principles of prophylasis which are now the firmly established ground work of all preventive

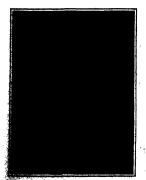


Pasteur, who discovered the medera method of treating hydrophob is.

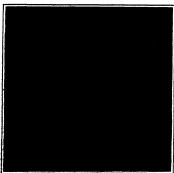
medicine And to the memory of Dr Paul Gibler, who established the Pasteur Institute in New York city, and to Dr George G Rambaud, its present head, is due acknowledgment for the introduction of the prophylactic treatment of rables in this country.

How effective is such prophylaxis? Look first into the past

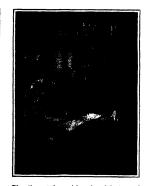
Hydrophobia is as old as human history. From the mass of material on this subject, we note that Lazaruta him centuries before Christ described how dogs, jackals, foxes, wedves, bears, tigers, became rabid, foaming at the mouth, which remained open, asilva showing from it; "their tails hang down, they do not see or hear well, they snap and bite at one another, and thus communicate the malady to their fellows? Plutarch (admittedly not their fellows? Plutarch (admittedly not their fellows? The fellows of the Aschpitade, the earliest known physicians. Homer described lietor as a "raging dog". That fable about Actaeon having been form to pleces by his own deck at the beheat of the chaste Diana, would seem to need revision in the light of modern science; probably the hunter was torn to pieces, but this by reason that his dogs had turned rabid. At least a dozen ancient writers referred to rables Damocritus (the laughing philosopher, who traveled extensively) not unnaturally contraveled extraveled.



find ander the migracepe stained elifer made



Shoop immunited against rables at the New York Pastour Institute.



Dissecting out the special portion of the brain of a dog to be examined under the microscope.

founded rables with tetanus. In 1371 there was a very notable epidemic of rables in which many French and German shepherds suffered. Many in Spain endured and died of tortures exceeding those of any luquistion, about 1500. In 1712 the Hungarian woods were infested with rabld animals. In 1713 to There were numerous spidemics of rables (in which women and children suffered most cruelly) throughout all Europe Fife, in Scotland, was in 1748 notoriously infested with mad dogs. In 1752 there were many mad dogs shout St. Janes, London.

In 1768 the people of Boston suffered much by reason of rabid dogs and foxes; as also in Philadelphia and Maryland in 1779. From 1785 to 1789 there was much canine rables in the United States; from 1805 to 1830 this disease was pandemic in many parts of Europe and America. In Pressia from 1810 to 1810 to 1854, rables claimed 1,078 victims; between 1830 and 1847 there were in Austria, 1938 human victims of bydrophobla. From 1856 to 1866 the disease was common in England, North Cormany, France and Spalis; Bavaris had every year from 1887 to 1873 800 cases in a total of 275,000 dogs. In 1889 the disease was rife in Paris; from 1870 rables prevailed in the North of England up to 1881 by rason of insufficiency of police measures. In France, between 1854 and 1850, the human deaths from rables numbered 1,000. For New York city there is the following tabulation by years of hydrophobles mortality:

Year.	Deaths	Year. Deaths
1855	4	1865 8
1856	3	1866 2
1857	2	1867 4
1858	0	1868 1
1859	2	1869
1860	0	1870
1861		1871 7
1862	1	1872 6
1863	3	1873 0
1864		1874 5

Tardieu and Boriey, in France, collected 855 cases, of which 399, or 468 per cent, died. This was before the Pasteur treatment by inoculation. Let us consider now the hydrophobia status since such inoculations were begun.

True bydrophoble is increasing in the United States, mainly by reason either of the absence of laws on the subject or of the laxily with which existing laws are enforced. Taking the country all in all, our preventive measures are allogether inadequate. If we take the experience of recent years for a criterion, we shall find spidemic rabine manifesting itself with the coming of warm weather. And there are very likely none of our States that have not a few cases of rables among dogs at all times. The disease is of rables among dogs at all times. The disease is of rables among Alaskan dogs. Our Pacific coast is considered to have been exempt until recent years; there are now cases in San Francisco, which are said to have had their origin in some rabid dogs brought from the East. Isolated cases of human infection have been observed in all sections of the Union.

In these respects we compare unfavorably with Europe. England has a muszling order—which ye the way, she enforces; in consequence the disease has completely disappeared in that country. And in matter of fact North Germany, where a qualming scophilis gets scent sympathy, the enforced muszling cold dogs has resulted in the practical elimination of rables. There, also, as in England, animals demonstrated to be infected are destroyed. In Berlin rables was common prior to 1876; since that year a law has been enforced requiring the killing of dogs suspected of rables, and the muszling and leading of dogs when in public places; there have been no cases of rables in that city since 1883.

Dr G. H. Hart, of the Bureau of Animal Industry Washington, D. C., has found the number of rabid dogs to be increasing. The frequency of hydrophobia in and about Washington has of recent years become alarming In 1907 a positive diagnosis of rables ie in 44 cases, in 33 of which the dogs had bitten 16 people, in 46 others dogs and two cows. And this is fairly typical of the general status of the disease in America. Dr Hart has well observe my dog lovers cannot appreciate, or are indifferent to, the anxiety, mental terror and suffering of several sand human beings in our country yearly, and the actual death of from one to three hundred yearly, not to mention the suffering and death of countless dumb brutes. But as soon as a muzzling law is pass owners of dogs are up in arms, using their time, infinand money to secure its repeal, or prevent its enforcement, on the graded of alleged cruelty."

There is certainly an unfortunate tendency among many citizens to despecate the importance of hydropholes, on account of the comparative rarity. However, the importance of a discusse should be estimated to the tendency of the cases, but by its gravity and virulence. There are again some miagnified people who dany altogather the estimate of such a discusse as hydrophobia. No doubt not a few animals—and some of them valuable, though in no properties to the human lives placed in joopardy—are unnecessarily destroyed in the fremay of popular excitement that excompanies an outbrack of rable, and which is much aggravated by the erroneous notions of the way a rable dogs behaves.

A homeless mangrel is worried and kicked about by a gaug of toughs; this, with the heat, the dust, the noise, the starvation and what not else, sends the poor beast scurrying through the streets. Let this pittible creature in self defense bite some one, and forthwith a "mad dog eare" is in full sway. The victous animal is then duly shot or hattered to death. How far better a fate than this were the laboratory for stray and homeless and ownerless dogs, where these unfortunate "companions of man," it unclaimed, would be put out of existence by humans mathods.

All dogs which run amuck are not necessarily rebid any more than all oddy-behaved human beings are demented. Yet the disease is or no means or rare as to be negligible. The Society for the Preveation of Cruelty to Animals has reported that its agents have been bitten 15,000 times without the development of a single case of hydrophobia among them; but this should not argue the absolute non-axisance of rables. Such agents are, by reason of their experience, able to distinguish between a peevish dog and a mad one.

n, fear of the consequence to persons bitten by Agai non-rabid dogs is apt to develop false hydrophobia lyssophobia which, although it is not fatal, is nevertheless likely to cause much suffering. The manifestation is here purely neurotic or hysterical. A nervous person bitten by either a rabid dog or supposed to be may develop within a few months symptoms somewhat resembling the true disease. There is irritability and depression: the patient feels his condition to be serious, and that he will inevitably become mad. He may have paroxymms in which he says he is unable to drink, grasps at his throat, and comes emotional. The temperature is not elevated. as in true rables, and the affection does not progre It lasts much longer than true rables, and is amenable to treatment. Most of the cases of alleged recovery of rables have undoubtedly been pseudo-hydrophobia. But for the prevention even of this condition, if for no other reason, it is imperative that the true status of every dog which has bitten a human being should be determined.

Rables is supposed to have originated with canine family—the dog, the fox and the wolf; it occurs in cats, horses, cattle, pigs, rats, foxes, jackals, skunks, etc., probably in the first instance by the canine's bite; most animals are susceptible; the is communicated by inoculation to the rabbit, horse sheep and pig. In the Western States the skunk is considered very liable. Even from the bites of rabid animals but 16 per cent at most of the cases are con sidered to develop true hydrophobia. The remainder escape, owing to the protection afforded by clothing, which absorbs the saliva and the virus before the fiesh is wounded, or on account of the slight extent of the wound or the virility of the natural antibacterial forces. The chief protection of the victim, however, in most cases resides in the fact that a e has not been severed or lacerated by the bite. Besides, Paltauf has demonstrated by autopsy on per-sons fatally bitten by rabid animals that the virus ultimately reaches the central nervous system; evidently the virus is there in many cases destroyed, without the development of rabid symptoms, by the natural defensive forces, which are reinforced by the immunising principle in the Pasteur treatment. Auother factor, upon which death or recovery may depend, is the difference in the virulence of the poison; for example, the bites of rabid wolves caus in about 6 per cent of those bitten, as against 6 to 9 er cent of fatalities from dog bites, and no d from subcutaneous inoculation of attenuated rabbit

The danger is greatest when supposed pagin are bitten. Freshly shawn sith allow penetration of the virus, a most important fact with relation is the fifthy habit of letting a dog lick the face. So desident is the disease and (when it has pussed the implietion stage) so inverhably field, that the component of common sense importatively commands that pipous-

If a bite is received from a suspected animal a physician must be summosed immediately. The older first aid method of suching such a wound is obviously

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what precedings are 100 to learn the very second was a second make the operation prescribedly assistant.

What proceedings are 100 to learn the very second was a superior annihilation of the learn the very second was a superior to them for observation; and they should be superior to them for observation; and they should present a place where such animals may be desired with a second control of the second was a superior to the observation; idea they should be superior to the second was a superior to the s

thirty-sight months after a bits. Immediately rable is demonstrated in the deg which bit the human patient, the latter should at once undergo the Pasteur incoultains. This is a procedure scientifically as well established as that of vaccination against small por. As a result of the Pasteur treatment, in 25,000 cases thus typsted, in, Paris from 1286 to 1901, issue than 1 per cent died of hydropholis, a like ratio has obtained in New York and other places. In 1908 it was reported from Kassauli, in India, that of 1.538 people treated with Pasteur injections, there was failure in 0.35 per cent of the cases; of 108 people bitten by supposed rabld dogs, and not subjected to the Pasteur treatment, 44 ded; of 154 persons bitten by supposedly rabld jackala, and not subjected to Pasteur incoultations, 48 died; of 154 persons bitten by supposedly rabld jackala, and not subjected to Pasteur incoultations, 48 died; of 154 persons bitten by auptosedly rabld jackala, and not subjected to Pasteur incoultations, 48 died; of 154 persons bitten to practice of the pasteur incoultations, 48 died; of 154 persons bitten to make the pasteur incoultation, 48 died; of 154 persons bitten to practice of the pasteur incoultations, 48 died; of 154 persons bitten to make the pasteur incoultation, 48 died; of 154 persons bitten to practice of pasteur incoultance in the pasteur incoultance is pasteur incoultance and the pasteur incounter income and the pasteur incoultance and the pasteur incoultance and the pasteur incoultance and the pasteur incoultance and the pasteur incounter income and the pasteur incoultance and the pasteur incounter incounter incounter incounter incounter incounter incounter incounter inco

Dr. Q. M. Stimson, of the United States Public Health and Marine Hospital Service, states that the Pasteur treatment may be obtained from the surgeon-general of that service, on application by health officers having moderate laboratory facilities for administering under their supervision. There are, mover, some twenty institutions in the United States in which the Pasteur treatment is available; a list of these is given in the publication, "The Prevalence of Rables in the United States," by the United States. The State State State of the State State State on 1909.

The Current Supplement

A MONG the more notworthy articles of the current Among the more notworthy articles of the current for Gradeovitr's description of an attempt made by Dr. N., Nathusius to combine the advantages of the Revoilt and Gird electric furnaces for reten insking, and Mr. Edward M. Hagan's paper on the utilization of the wastes of a blast turnaces for the insking, and Mr. Edward M. Hagan's paper on the utilization of the wastes of a blast turnaces. Art. Hagan's paper on the utilization of the wastes of a blast turnace. Art. Hagan's paper on the utilization of the supplies of the beight of aeroplants.—The greeness of single 'redaing are disclosed by W. D. Rioras.—The Election of Santa Carlos of Manufactures of the Department of Chapteries and Labor will soon issue a menagraph only packing the part of the most important publications over the part of the most important publications over the partment of the engineer of assured in publishment of the control of the engineer of assured to publishment of the control of the engineer of a series of lectores on subject our partment of the publishment of the control issue.—Other switches age. Carlos of the control issue.—Other switches age. Carlos of the form of the control issue.—Other switches age. Carlos of the form of the control issue.—Other switches age. Carlos of the form of the control issue.—Other switches are carlos of the control issue.

Col. George Washington Goethals, Çanal Builder

By William Atherton DuPuy

The February, the fight in Congress as to which the property of the Panama Canal should be the limit wise Bearing its close, Lieut-Col. George manifested Goethals, who is in charge of the work as in the property of the work of the property of the property of the property was practicable. He answered simply in the discount was practicable, the answered simply in the discount was practicable. He answered simply in the discount was practicable. He answered simply in the discount was practicable. He answered simply in the introduction of the lying quarters for the troops if Congress approved of the plan. His answer was another simple affirmative. When saked if the assuming of this additional task would retard the work on the canal, he said that it would not.

Upon these assurances Congress proceeded in subtonies the proposed forficiations. Congress has subtonies the proposed for fifthations. Congress has subtonied fatth in Col. Goethais. No one doubts that the fartifications will be in place when the first ship to mean one. Upon it is to be spent a minimum of \$13,000,000\$. Uring quarters are to be built for \$,000 troops. Coast defenses are to be constructed on both adds at the sheams that will rival any such works in the world. Their guns will be able to destroy any shattleship that comes within ten miles of the mouths of the canal. Land defenses are to be built as repal any invading frore that might be put ashore. The whole scheme of defense is ter-be such that its carrying out would be sufficient to make the reputation of any engineer who was assigned exclusively to the task.

But to Col. Gosthain it is to be but a side line. He has other tasks that are beyond compare in anything doing the world around. The building of the Panama. Canal's the greatest engineering feat of the age, perlays of the ages. This has been remarked so often that it has become a platitude. But it is magnifcently true. The man who is building the canal bears upon his shoulders such responsibilities as few men have borne since time began. Let us look into a few

of the details for which he is responsible.

There is the matter of keeping the canal zone signifier. Without never cashing vigilance diseases would steal in and sap the vitality of the entire force. Cowes may not be kept on the sone because cows make tupoks in muddy weather, tracks hold water, and standing water breeds mosquitoes. Severage is installed everywhere, pools are drafund, brush is cut. There is a string of hospitals across the istamus that provide everything that modern science can devise for the siling. The sick and each rate in the sone is lower than in most of the cities of the States, but Col Gesthair serious to allow under credit to be given for this, for, he states, the people on the isthmus are all in the prime of He.

In the some justice is administered in a way that In the some justice is administered in a way that Iganyres the customs followed in the States. Matters are expedited. There is no place for complaint against the law's delays. Col. Gotthale has developed a system of getting immediately at the justice of any osse. The cumbersome jury trial method is resorted to only in cases where the death penalty or life imprisonment is involved. Summary justice rules. There is dispatch, immediate action. No community in the States handles these matters of law in half the time they are handled in the canal

A system of recruiting labor has been built up that works Itself. There is never a dearth of labor on the isthmus. Frean, all over the world the workers come. Spaniards, Italians, Freach, Americans, West Indians, 35,000 of them in all, severing the same marker. The stream was at first started by recruiting officers who brought a, sew men from many points. Then the is-borers were well treated. They wrote been for their between and friends. An endies chain was formed. And still they come. There is no labor trouble. Col. Geschale claims that to has gotten together the best working force in the world. The force claims that it has that but has the labor the basic on earth.

has the best big bosis on sarch.

"Then three is the commissary which supplies every-shing that these \$5.000 men and their damilles sat and pear. There is not a meal supplied on the sons, facts lixurary at the Tivoli to the three ineals a day for dighty cents; that are provided for the West Indians, their does not depend on the commissary. It is no measure commercial undertaking to administer such a grantege. See high raise silency under the one of Col.

Guilleis.

Afthen there is the vani test under the department of understeller, and sugmenting that is the great contain the after all. The sets is divided into taxes with the contain the sets of department of the sets of department of the sets of a design amplified, two

army men and one civilian. There is the great Gatun locks and dam on the Atlantic side, the Culebra cut in the middle section and the locks at Pedro Migu and Miraflores and the channel to the Pacific Any one of these divisions has a monstrous work to per-form. In connection with the excavation at Culebra eration of trains in disposing of the dirt is in itself the task of a great engineer Yet all these things, even the detail of them, are under the direction of one man, a man who has not yet enough work and is willing and anxious to take on more. Goethals is a gourmand for work When Col Goethals took charge of the Panama proposition early in 1907, the machinery had been pretty well completed for the work. There is no man who gives John L. Stevens, the former chief engineer, more credit than does Col. Goethals

"Mr. Stevens," he is prone to tell the interviewer,
"is responsible for the success of the undertaking
He laid down the big plan. I am but following in his

"But," the interviewer may protest, "you have changed many things from the lines that were followed by Mr. Stevens."

"So would Mr. Stevens have made many changes had be remained in charge," will the colonel answer. It is the modesty of the man that thus attempts to stand out of the spotlight and give others the credit As a matter of fact there had been much excellent preparatory work done before Co. Goethals took charge. But the actual work of digging the canal had hardly begun. The present chief engineer is the man

who is the actual builder of the big ditch.

Col. Goethals is equally modest when enthusiasts
pyramid praises of the great engineering accomplishment on the isthmus. The colonel insists that it is
morely a matter of administration. He holds that he
has but to keep the machine going and that the task
will accomplish itself. He succeeds in convincing no
one but himself by this argument, but such is his
actual view of his position.

When Col. Goethals took charge of the canal bulling he did so in the face of a strong prejudice against him because of the fact that he represented the military branch of the government. The work was believed done by civilians, and these are always prejudiced against military methods. They object to the fron hand, to formality, to clockwork routine. The men on the job were loud in their protest against transferring the work to the men in the army

Coll. Gesthair realized this. He particularly avoided any show of military discipline. Mr Silvens had placed the different divisions of the work under given engineers and had instructed those men that they were responsible for the detail that fell within their jurisdictions. Col. Gesthais, on the contrary, took over a vast amount of detail all along the line. There is nothing too small to occupy his attention. Every day he walks over a third of the canal route. He starts at seven o'clock in the morning with the gangs of laborers. He trudges over the works until near noon. Then he gets aboard his car, which is a cross between an automobile and a hand car, and returns to his office. The afternoon is given over to the administrative datall. Often much of the night is given to the same work, for the man is absorbed with his great task. It is his life.

This is a way that the big work has of gripping men. There is no laborer from the West Indian mucker to the American engineer who is not enthused with the contemplation of the biguess of the thing which they are doing. The job is their life. It is a case of the oft repeated theory of the spirit of the man at the head of any enterprise permeating all those that work under him. The whole force has the Goethals brand of enthusiasm.

But in all of this there is little of the military in the manner of handling this civilian task. There is no better example of the lack of military methods and the assumption of unlimited detail of administration than 'he complaint day that Col Goethals set aside when he first went to Panama and which has maintained ever since. On complaint day any man, woman, or child between Panama and Colon may come to the colone's Ginca and tell his troubles Sunday is complaint day. Then the whole force is off work and heat to sleave. It can tell its tale of woe. Its story is listened to, and if there seems justice in the complaint something will be done in the matter. Col. Goethals is symmighthetic and diplomatic. Often the mere telling of the tale gives the necessary list. Often these seems is the colone's continued to the colone's colone in the matter.

edied. Often there is gotten a tip that leads to better administration.

One day a railroad engineer came to the colonels with a serious kick. He was being discriminated against. He was being made to haul eighteen cars. The other engineers were pulling but fifteen. He was a saked if he could successfully pull, his eighteen cars. He said that was all right, but it was the discrimination that he objected to. The colonel promised to so adjust matters that he would be placed at no disadvantage. Next day he issued an order that all engineers about pull eighteen cars.

"We are for him," said a great, hulking steamshove man to me the other day "When the colour comes along on an inspection tour he greats each band of workmen with a cordiality that makes them believe that they are the especial object of his affection. They feel that they are in with him on things. As a result they redouble their efforts when he has passed, feeling that they are not merely working for a living, but are working for the colone!"

are working for the colone!"

The building of the Panama Canal is to-day a demonstration school to all the world. There is not a day that it is not visited by scores of men from all parts of the world who are interested in engineering. Many of these men are the greatest engineers in their given countries When the work is completed there will probably be few big engineers who have not seen and studied the manner of it. The eyes of the world are on the job, and the lessons being laid down by the man who is accomplishing it are to be emulated the world around

There is no lack of appreciation of the import of the task on the part of Col Goethale despite his modesty with relation to it. If evalues that it will see that it saids that it is survey as the seed of the task that it is survey as the seed of the content of the world to undertake things intain have hitherto appalled them. He realizes that the stips of the world will constantly ply through the weterway and that its lessons will be constantly rought however the three terms of the content by the content three the example in annitation that the example in annitation that the example in annitation that content the example in annitation that the example in the interest of the world are here belong the example in the tropics. He knows that all the equatorial content to the example of the example

accomplished in thus linking ocean with owan Two years ago Col Gosthais stated that the canal would be completed on schedule time, that is by June 1st, 1915. This statement was taken as final and all preparations have been making to that end. While still holding to the original efficial statement, the engineer in chief now says privately that the waterway will be complete December 1st, 1913, thirten months ahead of time. This leaves a good latitude for the elimination of any difficult that may arise when the water is actually let into the canals and the looks There are still a few such possibilities as altides into Culobra, but the worst of these may be easily met with no great delay.

Col. Goethals is a tall, strong-limbed man, fifty-three years old. He is gray, curly-haired, good looking. His health is of the best, and work is but a stimulant to him. With him on the canal zone lives his wife. Their comfortable home is at the top of the divide near Culebra. It was built before he went to Pansma, and is probably much more elaborate than he would have built had the creation of his quarters been left to him.

With the colonel and Mrs Goethale at Panama is now their eldest son. This son graduated from the United States Military Academy nome four years ago at the top of the most difficult of the classes, that of engineering. He is following in the wate of his father. He is now stationed at Panama as a student engineer. The second son is now a juntor at Harvard and has elected not to follow the army as a call-ing. This is the extent of the Goethals family.

Col. Goethals was the chief engineer of the army during the Spanish-American war He has carried forward much of the important engineering work of the army for a decade before his appointment to his present post. Among his most important tasks was the building of locks and dams in the Tennessee River at Mussel Shoals for the improvement of navigation. He was a poor boy to begin with, and was appointed to West Point from Brocklyn by "Sunset" COx. He has made good ever shoe.



ditor of Handy Man's Worker is for this department and w The E4

Design for a Small, Reversible Rotary Steam Engine

Rv A. J. Jarman

Is it possible to construct a practical and efficient rotary steam engine? is a question that has often been asked by porsons who possess a good turning



A six-vane retary engine with cover plate removed.

General view of the three-vane rotary

lathe and other mechanical tools, and who are themselves good mechanics. The general run of rotary steam engines are complicated, and it would tax the skill of a good mechanician to construct one. The description here given will enable any one to con-struct a small rotary engine that is simple, powerful, and efficient.

Two such engines were constructed by the writer several years ago, one with three vanes, the other with six vanes, as the drawings and photographs will w The three-vane motor, when worked with m at a pressure of twenty pounds to the square inch, ran at a speed of 520 revolutions per minute, giving exactly one mechanical horse-power upon a Prony brake. The consumption of steam was not extravagant, and when running at this speed it could he reversed quickly by simply lifting the handle of the steam valve up or down, so as to throw the inlet and the outlet valves at the same time. The feed valve and the exhaust valve consisted each

of a two-way cock with short levers attached FIG 1 to the plugs, and connected by a steel rod, as shown in both the sec-tional drawing and the photo-graphs. The motion of the engine was extremely steady. presenting the appearance of an electric motor rather than a steam engine FIG.Z. The six-vaned FIG.3 motor gave no advantage over the three-vaned one. In fact, its

FIG 4

efficiency tests were much I view of the three-vane lower, while the three-vaned mo-

worked by where pressure as well, and could be worked by where pressure as well, and could also be used as a pump for water, oil, gas, or air, quie engine can be built in any size to meet the requirements of the builder. The three-waned engine here illustrated had a optimizer bore of 4 inches, which is discladed engine had a 8-inch bore. Fig 1 repre-

SMATH NO

sents the engine in section. A is the cylinder, in which the roller B revolves. The axle is fitted at O. This roller, with its three alots to receive the vanes, is mounted eccentrically with respect to the main cylinder. In the case of this one horse-power motor, it was one inch out of center. The roller revolved against the top of the cylinder, to keep the steam against the by the printer, and the presenting back pressure upon the vanes. The two-way entrance valve is shown at D and the two-way exhaust valve at E, coupled to the injet valve by a rod at F and G.

By tracing the movement of the handle H, it will readily be seen how the inlet and outlet are thus giving a reversed motion. The cylinder ends have a groove cut in them, so as to receive the metal segments shown at L, Fig. 2, which fit flush with the cover. These segments are the guides which rotate with the vanes to which they are pivoted, while K is a piece of T-metal fitted into the top longitudinal groove of the steel vane J, Fig. 3, with a steel spring at the base to press the T-piece against the cylinder. This T-piece is in fact a metallic packing. It will be observed that the vanes

observed that the vanes perform a perfect circle, the inward and outward motions being brought about by the eccentric mounting of the slotted roller.

The photograph of the completed engine shows a cast-iron foundation, so arranged that the twoway exhaust valve stands free. This is necessary to make the engine con plete in one piece, so as to be self-contained. The T-pieces are shown fitted in position in the photograph of the sixvane motor, the pressure spring being simply a curved strip of steel. The

T-pieces of the three-vaned motor were made of cast German silver, the cylinder being gun metal. If con-structed as a water motor, the outlet should be much larger than for steam.

Picture-framing Outfit

By Glenn W. Persons

THE Handy Man's Workshop is not complete with-out a picture framing outfit. A device for hold-ing the molding while nailing and giving which is ing the moding while nahing and giving which is practical can be easily made as follows: The clamps can be secured from the tops of two old clothes wringers by sawing about three inches on either side of the screw. The base of the device should be a 2-inch hardwood plank, or better still, two pieces of inch board glued together with the grain of one runting at their hapiters with what of the other. ning at right angles with that of the other. of the base ought to be 18 by 22 inches. A board 6 by



Handy picture-framing clamp.

8 and $\frac{1}{2}$ inch thick should be gived and screwed to the base as shown in the illustration. Holt the clamps to the base as illustrated, leaving sufficient space between the ends of the acrews and the koiding space netween the sense or the acrews and the somme board to place the widest moiding which one would use for any frame. This space must not be 100 wide, for the acrew has a tendency to spring up when heavy pressure h applied. Small blocks are to be used when narrow molding is being held, or on any molding which the end of the screw would dent. The diffaulty in making frames is in holding the pleess firmly together while nailing. With a little practice as good a joint can be made on this machine as with a hought device, if one has a true miter box.

How to Prevent a Small Drill from Breaking By G. A. M.

WHEN it is necessary to drill small holes in hard metal with a hand drill, it is often a diffisalt matter to prevent the drill from breaking. The pre-sure required to make the drill cut is often so greet that the drill is unable to withstand the strain, and

ing take a round p about 14 inch aborter the drill when in the obtok through the center with then ready for use.



sketch. If necessary to drill the hole more inch deep, when the wood begins to strike the wood reinforcing stiffens the drill so that it withstand three or four times the usual pressure

Underground Engine Music By Harry E. Wells

M ANY farmers and mechanics have gasoline en-gines which are objectionable on account of the noise from the exhaust. This agrise may be entirely done away with by the use of the simple number pletured herewith. Two barrels are connected by a pipe of the same size as the pipe that lends from the ar-



haust. Four small pipes are screwed into the top of one barral, and the exhaust pipe is fastened in the top of the other. Both barrels are buried so their tops are about six inches below the surface of the This muffer will stop the noise entir and on account of its size, it will not reduce the power of the engine, which the smaller ones have a tendency to do.

Magnetic Door Stop By H. F. Williams

HE sketch published herewith shows a magnetic THE sketch published herewith shows a magnetic bar used for holding a door shut. The object of this arrangement is to eliminate the use of the small door latch on inside doors, and thereby to save time in opening and closing the door. The device may also in opening his crossing the door. The derice may assort be used successfully in holding doors shut on places of furniture such as book cases, sideboards, and dressers. In the illustration shown herewith a straight magnetic bar A is set in the casing of the



door. A small square plece of iron 3 is faster the door. When the plece of iron in the door in contact with the magnet 4 the door is held but it can easily be released with only a slight ed of knob or handle on the door will



Making Life Figures of the Roosevelt Trophies

High Art in Modern Taxidermy

By Day Allen Willey



tion of African trophies secured by the loossvelt expedition for the United States National cum at Washington is now being mounted, or, to speak more correctly, sculptured. The work has progressed sufficiently far to enable one to form an idea of the realism with which the various animals and birds will be depicted in positions remarkably true to life. The collection when completed will form a notable example of the skill of the experts who are notable example of the skill of the capture was an objective during the various processes. When it is remembered that only hides, skulls, horns and hoofs form the natural bases for reproduction, the skill and labor required may be better resilized. Fortunately the consignment reached Washington in good condition, owing to the careful skinning of the tro hies and their preservation by packing themein salt.
The Roosevelt specimens reached the National Mu-

m in casks numbering over 100, most of them considerably targer than a hogshead and weighing, on an average, 800 pounds each. The skins had been dressed and saited in the field by the members of

the Roosevelt party, as stated. the journey from Africa the hides were packed in brine, and, thanks to the careful packing, all of the akins arrived in Washington in good condition. The first step in the prepararival at the museum we kshops was to send each hide to a tannery preparatory work was formerly per-formed by the museum experts, but it was found that economies of time and was found into economies of the lides expense were possible if the hides were sent to the tanning establish-ment. The process employed is the standard one known to commercial practice, but special care was exercised, owing to the value of the sperimens. When the hides were returned a special dressing by hand completed the preparation, and the specimens were ready for the actual mounting.

An interesting feature in connection with the reproduction is that these "animal artists" have no illustration, not even a drawing, before them, and work out the shape and proportions of ect from original models based on their intimate knowledge of anim anatomy. They really conceive the shape and dimensions. The miniature model might be compared to an architect's tentative drawing or the preliminary sketch of a picture. It is de-signed to show the pose and position which any of the given animals will be mounted, and it is especially valuable as a guide when many of the animals are to be mounted in groups designed to "tell a story" by representing graphically and faithfully some phase of jungle life. Such pre-liminary models are fashioned from medeler's composite"-a very pliable clay-like material—and the taxider. mist-sculptor may spend weeks of ef-fort and change his model many times re he has every member of a group in the pose calculated to set off the animal to the best advantage.

After the miniature model has been upleted and approved, the specimen White clay. Before he can unis task, however, the oursertions must spend days
solve studying his estipot,
solved specimen, the workman depolating his session for
many destination inclusive.

Two of the finest specimens. A striped hyens and a looperd.

Two of the finest specimens. A striped hyens and a looperd.

Solve studying the stripe of the finest specimens. A striped hyens and a looperd.

Solve studying the stripe of the finest specimens.

fore they were skinned. Apparently by inspiration the taxidermist proceeds to fashion a "make-believe" skeleton as a foundation for the life-size model he is to make This counterfeit skeleton is formed from wood and wire and iron, with the skull of the original animal put in its proper place to insure the contour of the head. On this framework he builds out of clay an exact duplicate of the animal. From this clay model, plaster of Paris molds are taken, just as a sculptor takes molds of his clay model preparatory to having a statue cast in bronze. At the National Museum a dozen or more molds may make up a complete animal figure, the number of sections varying according to the size, form and pose of the animal After the molds have been taken from the plaster model, the latter is destroyed, and now comes one of the crucial steps in the whole evolution, the casting of the permanent plaster figure upon which the skin is

Although the molds were made in sections, the figure of the animal is now cast as a whole. The

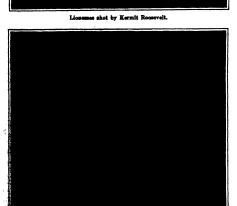
cast is not a solid mass, but a shell. The plaster used is reinforced by means of burlap and wire cloth, and this reinforcement renders the hollow figure of the animal much stronger than such a shell would be under other circumstances so strong, indeed, that a blow will merely result in a hole that can b repaired, instead of shattering the figure. When the cast is made, leg hooks or joints of metal-one for each of the four legs of the animal-are cast in plaster. and these canable the respective legs to be turned or removed at will It enables the skin of the animal to be fitted intact over the legs of the figure, just as a glove is drawn onto a hand. In this way it is possible to put a skin in place on a plaster figure with only a single cut to be sewed to This is located under the body, where it is not noticed Under the old "flat-skin" figure there was an unsightly seam the full length of each leg After the plaster shell has been completed, it is

given a coating of shellar in order that the skin may not come in direct contact with the plaster. Then

the skin is drawn over the shell, first having been wetted in order to make it more pliable. Ordinary glue is employed to hold the skin on the plaster form, but the "working" of the skin into place is a most intricate process. every wrinkle in the skin of the animal must assume its proper posi-After the skin is in place, it is wed by means of a ball stitch, with thread carefully selected to match the color of the fur or hair of the animal Next the eyes are put in position. The eyes for the Roosevelt animals are being painted in oil on half globes of clear glass, the experts believing that by this method they will attain mor accurate and lifelike results than could be derived with any of the "blown" eyes, as the manufactured product is

The Roosevelt collection at the Na tional Museum contains specimens of many animals which are the most difficult to mount. Most baffling of all mammals from the taxidermist's stand point is the hippopotamus Next in order of difficulty are the elephant, the "rhino" and the giraffe. At present the taxidermists are busying th selves with such less exacting subjects as lions, tigers, leopards, zebras and a buffalo, which latter is a puzzling proposition, because there are no similar specimens in captivity, nor any photographs of the animal in the wild state to aid the artist.

The original processes employed in the work are the ideas of Mr George B Turner, the chief of this depart ment of the museum



A German Use of the Sandblast

THE cutting and wearing power of a stream of blown sand, long since utilized for various purposes, has been employed for testing building materials at the Gross-Lichter-felde Institute in Germany Granite, pine wood, linoleum, and other sub stances used in the construction and furnishing of buildings are subjected for about two minutes to the action of a blast of fine quartz sand, under a pressure of two atmospheres. The results show the resisting powers of the substances tested to the effects of wear. This form of test is applicable to road-building materials.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Photography by Invisible Rays

I T is well known that on either side of the visible spectrum there is a field of radiations of which we cannot become directly cognizant by our sense of sight, although the physicist has found the means of procuring evidence of them. These are the rays of

shorter wave length than the violet, the so-called uitra-violet rays, and others of longer wave length than the red, known as the infra-red While the eye is not sensitive to the ultra-violet rays, the photographic plate is. and it is also possible to obtain a photoraphic record of infra-red radiation this day of scientific attainments we are becoming more and more independent of the limitations of our senses. If we want to obtain an idea of the appearance which the world would present to a person whose eyes were sensitive only to ultra-violet, or only to infra-red rays, we do not even have to rely upon our imagination, but, as Prof. Wood of Johns Hopkins University has shown, and explained in his Traili-Taylor Memorial Lecture, we can actually produce photographic views, concrete illustrations of the world "seen by invisible rays." To do this Prof Wood interposes between the object to be photographed and the plate a suitable screen, which transmits only ultraviolet or infra-red rays, while absorbing all radiation Considerable difficulties are encountered in realizing this arrange-ment, especially in the case of ultra-violet rays. Ordinary glass is opaque to these rays, so that it becomes necessary to use quartz lenses. Then the problem arises of finding a substance opaque to ordinary light, but transparent to ultra-violet is only one substance known which com-pletely satisfies this condition, namely, silver. If a thin fi'm of metallic silver is deposited chemically upon the surface of a quartz lens, a certain amount of ultra-violet light is able to struggle through and form an image upon the plate.

As acreens for the infra-red radiation rof Wood employs very dense cobalt glass As this, however, transmits blue and green, it is therefore necessary combine with the cobalt glass a layer of potassium bichromate solution, which cuts off the undesirable rays.

Some of the effects obtained by Prof. Wood are very striking, as will be seen by reference to our illustrations, which are reproduced from the Illustrated London The first two of these show a land-photographed in full sunlight by infra-red rays. The sky appears black, and effect resembles somewhat that moonlight scene A very peculiar fea-is brought out in the third and fourth of a moonlight scene illustrations The former is a view taken in the ordinary way by direct sunlight.

The second is practically the same view, photographed by ultra-violet light markable thing about this is the absence of the man's shadow' After what has been said above, it is needless to point out that of course glass windows or mirrors appear nearly opaque on photographs taken with ultra-violet light Another somewhat sur-prising fact is that Chinese white comes out black in such views Quite apart from the interest which attaches to Prof Wood's new

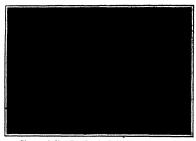
method of photography considered merely as a curlmethod of photography considered merely as a cut-osity, there is every probability that it will find a definite sphere of scientific and practical usefulness. An indication of this is given by a photograph of the moon in ultra-violet light, which brings out some features not otherwise observable When we remember the very important work which has been done with the spectrobeliograph within the visible spec-trum, the opportunity which exists for research be-yond these limits appears very enticing

Air Sickness and Aviation Accidents

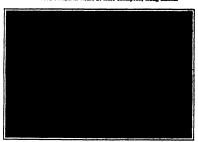
A FAUTOR often overlooked is the illness or "sick-ness" which has been attendant on all efforts of the living organism to adapt itself too hastly to a diffegent solies. Thus we have sea-sickness, moun-FACTOR often overlooked is the illness or "sick MENIS W.

tain-sickness, and car-sickness, besides that terrible disease known as the "benda," to which deep-sea divers and workers in causeons are subject, and which te due not so much to the enormous pressure to which they have been subjected as to a too sudden lessening of the previous pressure.

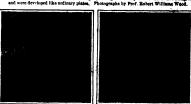
All these may be termed maladies of maladjusts To the list of these maladies a new one, that of air-



Photographed in full sunlight by the invisible infra-red rays



Like a snow-covered landscape in moonlight. Willows and other trees. raphed in full sunlight by the invisible infra-red rays. use photographs were taken in full sunlight; were given an azposure of about five minig and were developed like ordinary plates. Photographs by Prof. Robert Williams Wood



By courtery of Hustrated Landon No.

"The shadowle

A photograph taken under usual conditions and at the same time as No. 3 and showing that the same time as No. 1, showing that the same time as No. 1, showing that the same time as No. 1, showing that the

sickness, has recently been added. The subject has been attracting much attention of late, particularly in France, and two physicians, Dr. René Gruchet and Dr. Moulinier, have just presented to the Academie des Sciences a highly interesting report of certain experiments and inquiries conducted by ther

Air-sickness does not seriously affect those who fly at moderate heights. It reserves it terrors for those daring aviators who seek to attain exceptionally high

To some extent the mountain climber and the avi-ator seeking lefty altitudes work under similar con-But in the case of the airman there are two are

But in the case or one on the factors of great significance. In the first place, flight in a heavier-than the first place and the first place of t

situtes a continuous, cancent

which render the slightest volumetar at great life and limb, thus producing as a matter across tension. Then there is the temporary with which physical conditions are changed corresponding inability of the produced of the

It is this factor which the physicians show quoted consider most significant at the pro-duction of the specific symptoms of air-

In general high flights have a duration of 45 minutes at most. An altitude of from 7,000 to 10,000 feet is reached in from 30 to 40 minutes, and the descent is of course to ? minutes. Biplanes are somewhat slower of ascent than monoplanes, but, on the other hand, they require more labor

Thus we have conditions in all attitude flights of rather rapid ascent and vertiginous descent, these conditions affecting the character of the biological action.

from the pilot.

Character or the managerest account.

During ascent the respiration becomes quicker at about 5,000 feet, and the heart beats faster but usually without paintingtion. Nauson and the sense of inflation of the Names and the sense or singation of the stomach experienced by mountain climbers are usually absent, but there is a slight feeling of "malaise" or discomfort, which Morane attributed partly to the overpower-Morane attributed parily to the overpower, ing sense of intenas colludes. The bessing of the cars was not noted by Morane until nearly 6,000 feet af elevisims, but novices observed it at about 1,000 feet, and even the former is considerably lower than the height at which mountain climbers are af-

Morane states that the sight is always clear. "What makes it seem not op," he says, "is the great rapidity with which objects diminish and recode." He remarks, moreover, that when the day is fine but with a slight mist, the sun is reflected from the surface of the fog as in a mirror, so se to dearle the aviator. This phonomenon is Morane states that the night is always to dazzle the aviator. This phenomenon is especially annoying where there are eddles of air, and may seriously interfere steering the machine.

Even skilled aviators suffer from a slight dache encircling the temples at about

5,000 feet, while novices feel it sooner.

Cold becomes painful at about 7,000 feet. Above 5,000 feet, or even lower, the volun-tary motions tend to become more nervous and jerky and the reflex motions have more These motor modifications are easily explained by the combined effect of the cold, the quicker heart best, the slight shortness of breath, the ear troubles, the reflection of the sun, and the nervous ten-

sion and fatigue.

In descent the heart beats more strongly, but the palpitations which are soon felt augment according to the precipitousness of the

The rapid fall over a thousand fe minute-causes that peculiar feeling of emp-tiness experienced in a too swiftly descending elevator. There is a bussing of the ears ward the end, and this may increase in intensity at the end of the flight.

But the phenomena which are dominant and augmented as the ground draws near are the reduces of the face with a sense-

tion of heat and pain, the smarting of the eyes, moisture of the nostrils, headsche, and overwhelming fatigue, with actual drowsiness. This sleepiness is a yer presented to the Academic destyp interesting report of certain experitiries conducted by them.

Joss not seriously affect those who figs
ignit. It reserves it terrors for those
who seek to attain exceptionally high
on the mountain climber and the avy
int altitudes work under glashirs contone of the arman there are the second of the strengest desire
to keep them open. It one case a searching party
to altitudes work under glashirs contyp altitude contyp altitudes sarked feature, and in itself indicates the

only hast sovered hours, as done the of the circulation The latter is marked to the circulation of the histories with cyanosis of the circulation of the histories with cyanosis of the fluctuation of the

Christian all altitude-seekers should have the con-

Other review of this subject would be incomplete withhout reference to the psychical factor. This of the mest expert meet have confessed to curious in tellectual and emotional affections.

Morean spake of a sort of "angulah," caused in

Marans spoke of a sort of "angulah," caused in part by the feeling of intense colitude Another man, moted for his samp/roof and his virile energy, said that in the downward flight feelings of wretchedness and momentary fear seed ince, and the thought of a meadful death presents that, and is the more heyrible because of the semi-torpor of mind and body This montal and physical lethargy are spoken of

this mental and physical isthargy are spoken of by various aviators as preventing their performing as rapidly as is necessary the required mechanical acts which uphoids our argument that many accidents are photoshy due to the mental state superinduced by reclonated effort under unconstomed conditions

prompage error under unceasement continuous Emergence continuous Emergence that he was haunted by the thought of Chaves, schleving as immortal victory with a frightful death. Cavevir fagel accident, in deed, supports our sontention in crossing the Alps he rose very writiy to a great allfitude, from which he descended in a long, rapid gilds. The quick cleaching of this gilds by a sudden pull on the control wheel, is thought to have thrown such a strain on the wings that one of them broke off. It is highly probable that Chaves mintake was due to the control wheel, as the summarized of the modified was only the strain of the modified was not been considering of the modified waso-motor reaction, its hyper tension of the arteries headsche, vertigo, and somnelence. There may even have been some mental containt on the first the arteries headsche, vertigo, and somnelence. There may even mental containt the day vision of the galvest bright chitched of the containt the day vision of the galves by the chitched of the containt the them to be hundreds of the them to be hundreds of the chit of the control of them to be always to the them, the beautiful the time them to be hundreds of

It is to be hoped that appring aviators will regard seenations of discomfort and illness not as a matter to be ignored or regarded with a hero's disidain, but as grave warnings from Nature that there are fixed limits to the adaptability and especially to the possible speed of adjustment of the human mechanism, wonderful as that mechanism is

Eliminating the Scratching Noise in Gramophone Reproduction

THOUGH much progress has been made in per fecting the phonograph of late years, in one respect it must be said that the instrument has remained hitherto somewhat disappointing Inventors do seem to have succeeded in hiding the nature of the s by which the sound is produced ing of a hard record by pointed styli Superimposed upon the sounds which are intentionally prod the scratching noise of the tracing point. Add to this the unwelcome accentuation of certain harmonies ou of proportion to the natural intensity the net result ewhat in artistic value Whether these drav backs can ever be completely overcome in an instru esed upon a comparatively crude material mech or whether the final solution is rather to be looked for in an instrument of the Poulsen type for example, may here be left undiscussed. That the of phonograph is still capable of im common form or panegraph is still capable or im prevement will at any rate hardly be denied Some very premising results seem to have been obtained by John G McKendrick, who reports on them in

Notice The author says
"I have made many efforts to get rid of the hissing and grating noises that detract so much from the instrument as a reported over of musical seunds, and at last I have had an excurrating measure of success (his gramophone is inclosed in a woolen cloth lined hea, and a tube passes tightly through a hole in the wall of the box from the end of the taper arm that capties the sounds or the instrument. When the passes is tightly chough a hole in the wall of the box from the end of the taper arm that capties the sounds of the instrument. When the passes has been been as the control of the instrument. When the passes have been dealers and become of the samellar and locking the instrument of the same that the control of the samellar policy on the land and the control of the samellar policy on the land that the same that the same

nected with lengths of tin tubing, 1½ inches in diam stor, and the sounds are thus conveyed through as many feet of tubing as may be found necessary I have found the most efficient length of the entire tube, until it reaches the horn or resonator to be say 54 feet. The effect of the long tube while empty is to increase the volume of the tones but, of course the noises are also intensified

have always been struck by the fact that the fric tion noises seem to be quite separate and distinct from the musical tones either when a voice is singing with an accompaniment, or during the reproduction of an orchestral piece of music—indeed by an effort of attention, I have so trained myself that I can hear one without hearing the other This suggests that in the ear there is a mechanism for the detection of noises of high pitch as distinct from ordinary musical It occurred to me that by causing the sounds to pass through numerous narrow channels communicating with each other the noise-sounds pre-sumably caused by short waves of high pitch might be damped off by interference while the longer waves, corresponding to musical tones might pass through ered except as regards loss of energy from fric tion My purpose was attained by filling a segm of the tin tube say from 4 to 8 feet in length with a mixture of hard peas and beans corrugated by age or drying The experiment succeeded The friction noises were damped down, while the musical tones although rather 'dulled' in quality, that is to say they lacked brilliancy, were purer and, to my ear much more natural

Other substances were tried—giase balls marbles small fir cones, gravel, shreds of tim—but the best effect was obtained with the peas. Brilliancy was obtained by using as suggreeted by Mr. Ernsett do In Rue (who has been much interested in these researches) sinc tubes filled with fragments of corrugated sinc and the use of these has been protected by patent by Mr de la Rue By a combination of the into fragments with the peas and beans I git delight ful effects, so that the gramophone music is so immensely improved that I cannot listen with any pleas ure to the 'naked' gramophone sounds as the attention is not now disturbed by the 'frying pai' noises

As listening to music so reproduced is a kind of anditory illusion may contrivance that will beighten the illuston may be groced to give more pleasure if the Illusion is of the right kind. Unearly one redshift in the music apparently rising from the bottom of the horn more especially in listening to a human voice. To get rid of this I angle the horn so as to reflect the sound waves from a timefactor (parabolic in character) so placed as to send the sounds to the other side of the room. One then ceases while intending to think of either the gramophone or the horn as the sounds come from the reflect in much more real and natural

I believe the application of this method of acous icial filtration may be applied by ingenious me hanics in such a way as to do away with the necessity of using such an extended length of tube. The method neables one, in a room of moderate size to listen to pure music. One cannot help observing how it meliows a voice that, heard in the ordinary way sounds harsh (from the production of overtones of high pitch) and how it brings out the pure tones of the string instruments. The various instruments in an orchestra sound better. Everything is reduced in proportion and to use an illustration from art it is like passing from one of Etty a huge pictures to a delicate and beautiful Meissonier in which one sees and appreciates every Meissonier in which one sees and appreciates every

An Electrically-heated Steam Boiler

A STEAM generator is made by a New York firm for use on trains running over sections of line in which electric locomotives are used. The generator consists of a sprindrical bollen arranged with its aris vertical and having tubes catending between tube plates at the top and bottom. Into each tube which is closed at the bottom by a cerve plug there is slipped as electric heating element. This comprises a number of steatist tubes threaded on a metal rod with special stellate percelain insulators of larger diameter between them. These porcelain insulators fit into a thin brass tube and serve to keep the resistance wire, which is wound on the steatist tubes, out of contact with the brass tube. Fine silliconus and is used to fill up the space between the resistance wire and the interior of the brass tube All the elements are connected in parallel to bus bars through fuses which blow when the current rises to 6 per cent shope mormal. A botler 5 feet 10 inches in dismeter and 4 feet 6 inches long (between tube plates), with 148 5-inch diameter tubes, has a mariwas highest places, of comme, deathed up in a number of signer.

mum evaporating capacity of 850 pounds of steam per hour at 110 pounds per square inch with current at 686 volts It gave an efficiency of 919 per cent at 653 volts and 470 amperes in a New York Central locomotive

Port of Brussels

PIECE of engineering work is now being car A ried out at a cost of \$10 000 000 in order to nect Brussels with the sea by a maritime canal and thus make Brussels a scaport. The enlargement and transformation of the old Wilkbrock canal commenced about ten years ago as a result of a long campaign in the press and numerous meetings in which it was pointed out that such a farge center with 770 000 in habitants should no longer be under its present dis advantage and that it should give entrance to sea going vessels so as to become one of the important European shipping enters The old canal was laid out in the sixteenth century on the plans of Burgo master Jean de Locquenghien and it ended on the seacoast near the mouth of the Fscaut It belonged to the city of Brussels but when it came to transform ing it a large financial enterprise was formed includ ing the State the city and the neighboring com The work comprised the enlargement of the old canal so as to give a maritime canal the construc tion of a suitable port at Brussels with its basins, docks and storehouses and the company is afterward to keep on operating the canal A draughi of 19 feet 6 inches is allowed for vessels and the width of the canal at the water line is 130 to 200 foot and at the bottom at least 80 feet for the standard sections For the enlarged points used as a by pass for vessels the canal width is 230 to 330 feet Between Brussels and Antwerp there are three maritime locks of 52 feet width 480 feet length and 2. feet depth together with smaller sized locks of 220 feet length and 28 The new port at Brussels will comprise a maritime basin and a foreport the first measuring 2 700 feet length and 400 feet width while the avail able length of the quays will be no less than 5 600 feet. Railroad trains will be brought alongside the basins in a special dejot of large extent covering over 60 acres and this will suffl e for a daily traffic of 800 cars. The forejort will be 300 feet width and will have 6 300 feet of quays for the landing of large vessels All this great work is now nearing completion, and it is expected that it will be finished dur ing the present year

The Application of the Gyroscope and Compressed Air to Taking Moving Pictures

a paper published in the Comptes Rendus M G de Proszynski remarks that the scope of the kinematograph for non artificial views—in other its scientific utility-is at present very limited owing to the necessity for posing the instrument on a very steady base. The tremblings which injure definition if the instrument is not sufficiently steady fall under four headings (1) Movements of translation Oscillations around the optic axis (3 and 4) Oscillations around axes perpendicular to the optic axis The effect of 1 and 2 is negligible To obtain a sharp impression it is sufficient to annul or reduce oscillations 3 and 4. This Proszynski does by am ploying a gyroscope with its axis paralici to the optic of the apparatus The requisite dimensions and velocity of the gyroscope may be calculated from con sideration of the admissible maximum displacement of the impression on the plate in a given time and of the forces due to shaking of the hand and weight of the apparatus. The gyros ope however only annuls short ripid movements and does little to counteract slow movements such for example as are imparted to the apparatus by turning the handle avoid this inconvenience de Proszynski has con structed an automatic apparatus comprising a pneu matic motor which is at once light powerful and very small The air reservoir can be recharged by means of a small hand pump

Light and Sound Waves

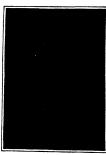
W 17H reference to our ability to tell the direction from which sound proceeds attention may be called to an interesting difference between the eyes and the ears in relation to the size of the waves that strike them

The average wave length of light is about one ten thousandth of the diameter of the pupil of the eye on the other hand according to Rayleigh the waves of sound proceeding from a mans mouth area about eight feet long whereas the diameter of the passage of the ear is quite small, and could not well have been made a large multiple of eight feet. One consequence of the minuteness of light waves in compart soon with the size of the eyes is that the lenses of the eyes are able to concentrate rays of light upon the retines with great efficiency

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Principal Examiner Giles S. Rafter G New State, but prior to his entry into the Patent Office in 1882 was a lawyer in Kansas. On entering the Patent Office he was for a while in the division of Prof B S Hedrick, and took his de grees in the law in the National University in Washington, and after



Principal Examiner Giles S. Rafter.

short service in Prof. Hedrick's division was transferred to the division of paper manufacturers and printing, where mos of his experience as an assistant examiner was gained. He was still an assistant in this division in 1904, when promoted to be principal examiner

In the division of paper manufacturers his attention was devoted principally to the complicated class of inventions relating to typesetting, justifying and distributing machines, and linotype ma-chines. While examining this class, he had charge of probably one of the most complicated applications ever presented to the Patent Office. This was the appli-cation relating to the Paige typesetting, justifying and distributing machines. The machine itself was one of the most complicated ever invented, and the patent eventually granted is the most volumin ous ever issued Ordinarily machines are adapted to perform an operation, or cycle of operations, and continue to do so indefinitely; the Paige machine, however, has its operation determined by the condition of each line of type with respect to the length number of word spaces etc., taking note of such conditions with machine sense, and then proceeding automatically in its operation in accordance with the requirements of that line Two applications were filed to cover the machine, one relating to the general organ-ization and having 204 sheets of drawings, but eventually limited to 163 sheets. and the other with Mr. C joint inventor, relating to the justifying features, and having \$1 sheets of draw-It was desired by the applicants and the examiner that the examiner permitted to go at the expense of the applicant to a distant city and examine the application in connection with so of the machine as had been constructed, and the working drawings. When the Commissioner's consent to this arrangement was sought, he refused to agree, on the ground that it was against the policy of the office, and if it was done in one case, might be done in another. The examiner urged that this was an extraordinary case, and in supporting his position asked the Commissioner to pe mit him to bring the applications down in order that their magnitude might be he was appointed principal appreciated. It is said that several mes- and assigned to Division 4. ngers were required to carry the applications into the Commissioner's office and the exhibits in the case were so formidable that he could not further refuse to permit the assistant examiner to make the trip.

The machine was a result of nearly twenty years of constant work by ar able engineer and inventor, and the original machine is now said to be in the possession of Cornell University. The patent is one of the curios of the Patent Office that so robust a man both mentally and physically as Examiner Rafter had the matter in charge. Many men would strain incident to the examination of so complicated a machine.

Mr. Rafter at present has charge of Division 2, including such important a metal coating on various materials, by classes as presses, tobacco, label affixing spraying a cloud of finely atomised metal machines and pneumatics He has a temperament eminently fitted for the examining duties, which, reinforced with a strong physique, great application and a fine capacity for work, makes him a very useful examiner.

Principal Examiner Benjamin W. Pond.

I T has often been a matter of conjecture why so many patentees and patent attorneys preserve their mental vigor and alertness through long periods of great activity. Of such preservative effect the subject of this sketch is a splendid example. He was a principal examiner in the Patent Office when most attorneys and examiners of this time were school and he has pursued way through the years, with the cordial respect of all and the warm regard of those intimately associated with him Mr. Benjamin W. Pond was born in

Bangor, Me, son of the Rev Enoch Pond. president of Bangor Theological Seminary, and passing through the public pols of his native city, entered Bowdoin College, from which he graduated with the class of 1857. Following in his father's footsteps, he was bred to the hurch, and occupied the pulpits of Congregational churches in several places until the spring of 1873, when failing health required him to seek a milder climate than that of his native New England

In the summer of 1873, upon the results of competitive examination, he was appointed a third assistant examiner in the United States Patent Office, and was promoted rapidly until, in August, 1877, state, as experiments made at the Zurici

and assigned to Division 4, which has ever since been in his charge; a period now of nearly thirty-four years. iner Pond's Division 4 includes the important classes of bridges, conve cranes and derricks, hoisting, excavating, hydraulic engineering, loading and un-loading, and metallic building structures. covering a very active field in civil engi

Mr. Pond is not only a gifted th ical engineer and mechanic, but is an accomplished practical mechanic, and is recognised as a particularly elever narv

A New Method of Metal Coating By Our Paris Corre

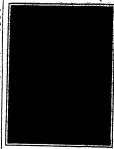
SWISS engineer, M. Schoop, has invented a new process for producing particles upon the surface to be cover The new method was first demonstrated Association of Zurich, and has since been emy of Sciences by Prof. D'Arsonval.

he metal is melted in a crucible d and is allowed to escape by a capillary open ing g, under a pres surface of the melted metal by compressed air or other gas. Just after emerging from the opening, the thread is atomized by a mas or steam soray, so as to form a cloud of finely-divided tallic particles. Through this cloud is passed very rapidly the object which is to take the coating. An inert gas is bes used to give the pressure on the meited metal, while anether kind of gas can be used for the atomizing. If desired, such a gas may be used at this stage as will oxidize the metal, so as to give a coating of oxide instead of metal. The action of depositing the metal appears to be as follows:

When the metal is atomised in the form of a cloud, its particles strike the surface which is to be covered, but here they lose their original spherical form and are flattened out upon the surface into blotches which units together and form a continuous layer of a certain thickness over the object. The metal is projected at a very great speed from the dns why the par orifice, and this expl ticles which are no longer liquid when they reach the surface of the object, ar able to make up a homogeneous and very compact layer whose density is all the same as for the metal in its usual

and the second s

metal has been melted in the symplety the ected but by this process, so that is no difficulty in depositing it up readily combustible substances, such as paper, wood, celluloid, or even animal tissues. The deposits of metal thus propared are much harder than those

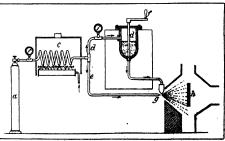


Principal Examiner Restauris W. Po

tained by the usual methods. stance, tin, when cast, showed only a little over one-half the hardness of tin little over one-half the naruness of the applied by the Schoop process, when tested by the Brinell method of despiting a steel ball and observing the mark made by it. Under the microscope there applied to the control of the control peared to be no difference as to the fineness of the structure as compared with the ordinary metal.

The new process lends itself to a num er of interesting and useful applications, since most of the common metals can be deposited in layers upon various surfaces. One very important use should be the coating of structural iron to protect it against weathering. The opera-tion should be readily applicable to finished structures, such as cranes, bridges, etc. There should be no difficulty in making the coating apparatus portable, so that it can be used on the spot to coat the ironwork all over with a nonany kind of paint, and, as the inventor claims, also more economical. ous applications which suggest themselves for the new process might be divided into two classes. On the one hand we may wish to coat an article for de tive or protective purposes; on the other over an article, in order to subsequently strip it off in form of a mold. Additional are the coating of wood, percelain or glass, to render their surfaces conductors glass, to render their surfaces community of electricity; and the metal coating of glass mirrors, whether parabolic, spherons other kind. ical, plane, or of any other kind;

Among the uses which may be made of the process for the purpose of applying a protective coating, may be men tioned the encasing of telegraph poles at the end which is buried in the earth, and especially at the point where they ex-from the ground. By metal-con wooden propellers for airchips and aero ses the double purpose may be serve of imparting to them a protective ing and reducing their friction. A ing and reducing their friction. A peck-likar application is the deposition of as-signatures have one-significant relation an install their space beliefs excellent whereby size is an employed and particular later. Cheshalt the facility can be seen to the contract of the contract of the con-line.



sepleted by model coating populated by meaning three three matterly closed, and can desid again without showing ob-gress thaving been spened before. Semestrate for tinfoll, such as eranning chocolate and the at he made by metallising paper, way given a bright or satinized The somewhat perplexing prob m of spating metal or other substances aluminium seems to be most satis This application alone der the new process very valuable er uses which have been suggested the metallising of textile fabrics, of the inner surfaces of new pneumatic tires, the coating of bettles and other els for use in chemical industries callising of carpets for theate stions, and numberless others which will readily occur to the re-

Examples of the second class of appli-ation mentioned above, in which the occes is used to produce a surface old, are the manufacture of printing blooks, stereotype and matrices, and the tion of a variety of articles ordimarkly prepared by the galvano-plastic precess. There is no difficulty in making hollow objects, such as, for instance, seamless metal tubes. The possible applications of the new process seem. in t unlimited, while the inventor claims that in point of view of economy his proc s easily wins over most of th matheds at present in use.

The Work of the Washington Conference

THE conference of Washington of the International Union for the Protection of Industrial Property came to an end on June 2nd, when an agreement was signed, which will be amendatory to the Paris Treaty of 1883. Of course the nature of the agreement will remain secret until it is ratified by the respect ive governments.

e sessions of the conference have been extremely interesting, and the conof Washington will be honored it is stated, by the addition of several nion nations to the ranks of the union or adhering nations.

The weather at Washington was extremely hot throughout the conference rved to bring the deliberations to a speedler close. The thermometer stood in the neighborhood of 100 degrees dur-ing the opening days, and many of the gates worked with their coats off, ch established an absolute precedent so far as international conferences are concerned. It was indeed an unusual sight to see the distinguished diplomats arrayed in their shirt sleeves, collarless and in many cases vestless, guiding the destinies of international patent and trade mark laws

The foreign delegates were the guests of the United States on an excursion to Atlantic City on the 20th of May. A special train was run over the Pennsyl-Railroad, and accommodations were arranged at the Hotel Mariborough-When the party discovere heim. a difference in stamperature of about 40 a difference in-gamperature of about and he degrees between Washington and he New Jersey resort, it was with difficulty that they could be induced to return to the capital. The majority were in favor continuing the deliberations at Atthe atmosphere combines thoroughly delightful,

de prigrimage was made to Mount wrates, the temb of Washington, where memorial wreath was presented by the traign delegates, and a speech was Georges de Ro, the vice

resident of the conference, and one of the states for Belgium.

This want of the formal untertaining

since, and the five United States deli gates, at a banquet, at which nearly two hundred guests sat down. The banquet was held in the large hall of the Hotel New Willard, which has been the official edquarters of the conference. bassador Tower presided at the banquet, and made an address of welcome which was very happy in its vein, and in which he complimented the conference on the rapidity and thoroughness with which its abors had been conducted. The Ambassador of France, M. Jusserand, ad-dressed the guests in French, and laid a great stress upon the world-famed hos sitality of America, and congratulated the delegates upon their good fortune in being able to see Washington and the United States under such favorable circumstances, as the gr M. Jusserand closed his remarks with an address in English. Not to be outdone the British Ambassador, Mr. Bryce spoke in English and wound up with complimentary address in French. He was followed by the Mexican Am-bassador, who spoke of the great sympathy that the nations of the earth and particularly the United States of America had extended to his countrymen in the time of their national sorrow and peril, and was warmly applauded. The Min-ister of Portugal, Vicomte de Alte, spoke on behalf of the delegate diplomats to the conference, and M. De Ro, on behalf of the delegates in ordinary. The Seca speech full of humor and good sense, which was much enjoyed. Among the guests were the Turkish Ambassador, most of the ministers and envoys ac credited to Washington who were in the apital, and a distinguished list of charges d'affaires and secretaries of em-bassies and legations. The Secretary of State was unable to be present on account of illness, and the President had already sent his regrets, on account of an engagement of long standing.

The President received the delegates at the White House during the second week of the conference and each had the opportunity for a word with him. manifested a deep interest in the subject of the revision and unification of inter national laws relating to industrial propof the delegates were preerty. Many sented to the President in person by their ministers and ambassadors. Mrs. Taft entertained the conference at a garen party on the White House lawn, a function that caused particular delight among the foreigners, all of whom have shown a most gratifying interest and in the attentions paid them in

this country. M. Capitaine of the Belgian delegation has planned a trans-continental trip at the close of the conference, and he will visit Yellowstone National Park, Yose mite National Park, the Grand Canyon of the Colorado, the Canadian Rockies, and all the cities of the Pacific coast. M. Capitaine is the leading patent attorney of the very important manufacturing city of Liege, and will during his trip make a study of trade conditions. He is an expert upon the subject of the international protection of industrial property.

Col Horbert Hughes the law clerk of the Sheffield Cutlers Сопрапу, companied the delegation of Great Briain as expert adviser, is a student of hattlefields, and has embraced every opportunity to visit the famous battlefields in the vicinity of Washington and Richmond. As Maryland and Virginia are rich in traditions of this sort, Col. Hughes, in addition to his official duties, has been a very busy man.

A Prize for a Safety Lamp

Notes for Inventors

A Rapid Manual Brake Wanted for Trolley Cars.—In talking with an official of long experience in electric traction lines, both city and suburban, the write asked him what is the most needed im provement in traction systems in a me chanical way. His reply was surprising but the promptness with which it wa made rendered it the more convincing. He said what is most needed right nov is a rapid action manual brake. In other words, a manually operated brake that can be quickly applied, something b tween the slow chain winding brake and the quick air brake Of course, the brake should be strong, be capable of applica tion without too much effort by the mo torman, and should be expable of ready and economical application

The New Congressional Committee of Patents. Trademarks and Copyrights .-The old patent committee of the Representatives lost only four members of its fourteen in the recent political ical shake-up, but probably many of the members of the old committee will not be on the new Committee on Patents of the House of Representatives.

Mr. William A. Oldfield of Arkansa

is the new chairman of the Patent Com mittee, and the Democratic member thereof have been named as follows: M forrison of Indiana, E. Y North Carolina, Frank Clark of Florida Joshua W. Alexander of Missouri, R. J. Bulkley of Ohio, M. W. Littleton of Nev fork, Oscar Callaway of Texas, S. A Witherspoon of Mississippl

The geographic distribution of the Democratic members is somewhat pecu as the North and East have but small representation among the members. Mr Oldfield, the chairman, is en thusiastic upon the subject, and like most of the members is a trained lawyer

Don'ts for Air Brake Inventors .-- An inventor is always interested in what to do, what to invent, what it needed, and similar propositions, and should there fore attend the negative side suggested in what not to do, or "Don'is" The last annual report of the Block Signal and Train Control Board to the Interstate Commerce Commission contains some ad-vice under the head, "Don'ts for Air Brake Inventors" Some of these which Brake Inventors" Some of these which are quoted below are not confined to air brake inventors, but have a general application to all fields of inventive activity. Notice the following:
"Don't be satisfied with yourself or

your first or even last idea of a device. Look for the defects, not the merits in any design you propose to patent. The latter will always take care of themselves. An apparent success, however, is oftentimes more fatal than flat failure The latter at least tells the truth and usually teaches a valuable lesson; the former raises false hopes and obscures the truth, and results in a corresponding greater failure when the final reckoning

Also this very brief, but important piece of advice:

"Don't attempt to find a remedy for s known defect by getting around its effect but first discover the cause and overcome

As to the human equation in its rela tion to "fool-proofness," the following is worthy of thought

"Don't overlook the fact that sim plicity interchangeability, fool-proofness and low first and maintenance cost, ofter have more to do with the success of device than ingenuity of design or nicety of construction."

Some Interesting Recent Patents. -issued, we refer to one numbered 989.714 for a watchmaker's appliance, including a stethoscope which is applied in operais by M. Georges de Re, the vicelikes of the conference, and one of I as amounced in the daily press that
a stellacope which is applied in operalike. Whaton Churchill, Home Secretary
the confered on, these of the created one of I are the confered on, the confered on the spirity patents 989,722 and 989,723, to Richard H.

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the print of the print of the confered on the confered on the print patents 989,722 and 989,722 and 989,702, to Richard H.

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metals and for compositions for use in cess; patent 989,927, to George M. Saybolt, for a process of obtaining naptha from natural gas; patent 990,121, to Franklin J. Drake, U. S. N., for method and apparatus for lifting fogs, including the projection upwardly through the fog at suitable intervals of columns of gases under pressure, producing currents dissipate the fog; and patent 990,183, to Charles G Ashley, for a relay in the form of an instrument for increasing the amplitude of wave form current, including windings as defined in the said pat-

A Design Patent for an Animal Trough. -A recent design patent for an animal trough, presumably a hog trough, arouses curiosity as to how far the ornamental features of the trough will affect the gastronomical ambitions of the animal, and recalls the old story of the scientific stranger who rebuked the farmer for feeding his hogs hard corn instead of soaking it over night. The former asked why that was better, and the stranger said the hogs could digest the soaked corn in one-half the time they could the unsoaked, whereupon the farmer sa 'Stranger, what do you calculate a hog's

time is worth around here, anyhow! Relieving Automobile Tires of Weight. The writer's neighbor has a new automobile, high powered and heavy, resting with much weight on its tires. His proposition is to jack up the machine the tires over night to relieve the tires of the pressure when the machine is not in use. It is troublesome to place and operate four jacks independently With in use. the power right at hand in the engine of the machine, it seems that someone should be able to devise a convenient, readily-operated lifting device which could be actuated by the power of the machine to lift the four corners of the machine simultaneously and thus relieve the wheels of the weight

A New Lightning Arrester.—A pate No 991,483, has been granted to E E Creighton, assignor to General Electric Company, for a protective device including a lightning arrester which has elecdes separated by a spark gap of stant length, and which develops in a direction opposite to the movement of the vapor liberated from the electrodes a gas blast whose velocity is greater than the velocity with which the vapor moves across the gap so that the vapor is carried away from the gap and thereby the formation of an arc is prevented when a disruptive discharge takes place between the electrode

Another Air Brake Patent .-- A patent. No. 991,538, has been granted to Walter Phillips of London, England, assignor to the Westinghouse Air Brake Company, for a fluid pressure brake in which an electro-magnetic device controls the brake cylinder pressure and an electric generaor which is driven by the momentum of the vehicle for varying the supply of current to the electro-magnetic device acthrown into action when the brakes are applied.

A Woman's Invention. - A patent. No. 991,496, has been granted to a Kansas woman for a guard for the wheel and bobbin winding mechanism of a sewing machine, which guard has two upright members, one extending alongside the flywheel and around the rear edge of same and the other extending around the front edge of the flywheel the members being connected together and means being provided for securing them to the base of the machine

A Cosmetic Rooklet --- A patent (No 990,270) has been lasted to a London lady for a cosmetic booklet which has a number of leaves saturated with a rouge composition and interposed waxed leaves which are perfumed their scent to the saturated leaves, per forations being formed so that leaves may be conveniently torn off as in the ordinary postage stamp books.

Legal Notes

The New Federal Judicial Code.—By John A. Mallory.—In the excitement of the struggles in the closing days of the measures "Judicial Sixty-first Congress over measures of more general interest, the "Judicial Code" passed into law almost unnoticed. The changes made by it in the judicial system are important, and, although ther do not take effect until January 1st, 1912 some general mention of them may well be made now

The code as framed by the Commis sion to Revise the Laws, was a revision of the whole of the title "Judiciary" of the former Revised Statutes; but, as acted, it contains only provisions relating to the organization and jurisdiction of the courts. All that relates to procedure and evidence, to officers not directly attached to the courts, to fees, etc., is left for other parts of the general revision, mostly, it may be presumed, to be included in a Code of Procedure

The one great change made is the entire abolition of the Circuit Courts. The appellate jurisdiction of those courts having been taken away by the act of 1891 which created the Circuit Courts of Appeals, the original jurisdiction still left to them, and all their nowers and duties, are now conferred on the District Courts. Thereby all the federal jurisdic tion of courts of first instance is con-solidated in the District Courts. The appellate jurisdiction of Circuit Courts of appeals and of the Supreme Court remains unchanged. The system of courts of general jurisdiction will be, therefore one court of original jurisdiction, intermediate court of appeal, final in many cases, and one Supreme Court, of final jurisdiction. This general plan was originally designed for the federal ju-dicial system, and has been adopted in many of the states

The provisions relating to the three courts of special jurisdiction—the Court of Claims, the Court of Customs Appeals, and the Court of Commerce-are included in the code in separate chapters.

The commingling of original jurisdiction in the Circuit and District courts at present, which gives to both concurrent jurisdiction of most cases, but to each exclusive jurisdiction, respectively, of certain other cases, has long been a cause of perplexity and confusion. The re of this difficulty and unification of all procedure in the first instance in a single tribunal will be welcome to litigants and to lawvers.

To the general public, and to the Government, in the administration of justice, the simplification of organization will be very beneficial. We have now 77 judicial districts, in most of which divisions have been created, or two or more places designated for holding courts, so that courts are required to be held in some 276 different places. In each dis-trict and division there is necessarily naintained the complete organizations of both a Circuit Court and a District Court. with all the officers and equipments requi-site for holding court in all the places designated. This expensive duplication of judicial machinery will cease, and the conduct of judicial business in a district by a single court should be more efficient and consistent, as well as more

This change might well have b ade in 1891, as was proposed, when the appellate jurisdiction of the Circui-Courts was transferred to the Circuit Courts of Appeals, then created As the Circuit judges have been almost wholly occupied in the latter courts, the work in the Circuit Courts has devolved more and more on the District judges, who now, sitting alone, usually hold both Circuit and District Court, at terms ap-

to the indicial districts themselves. Since the districts as existing in 1873 were defined in the former Revised Statutes acts of Congress creating new district and divisions of districts have secumin lated, forming a very complicated series of provisions. These have been very of provisions. These have been very carefully revised, and inconsistencies and discrepancies removed, and the seventyseven districts and their divisions, as now existing, have been described, and the territory included in each, where necessary, defined anew.

necessary, connect anow. The agis thus creating new divisions or designating new places for holding courts usually provide where suits of a local nature shall be brought, where process shall be served, where procecutions for crime shall be instituted, when and how cases may be removed from one division to another, how pending cases are to be disposed of after the di is established when and from what places juries are to be drawn, and for various other matters of local procedure. These provisions, of merely local application, and varying in detail, though for similar and varying in detail, though to simular purposes, have all been eliminated, and their place supplied by general pro-visions covering all such subjects, and applicable to future changes.

The new code is based on the Report of the Commissioners to Revise the Laws. of the title "Judiciary," to the extent of the portions of that title covered by the code. That title was reported by the Commissioners originally in 1901, and finally in 1909. Comparison with the code as enacted demonstrates that the Joint Committee of Congress on the Re vision of the Laws, besides incorporating recent legislation, must have expended much care and labor on the details of the code, in adjusting its provisions to one another and to existing and future conditions. The result is a great im-provement in the form of the laws on the very important matters cover West Publishing Company's Docket.

Employer and Employee.—In the case of Ladoff v. Dempster, Dempster v. Ladoff, decided by the Court of Appeals of the District of Columbia March 8th, 1911, the Court, by its Chief Justice

"The principle is well settled that if one employed to carry out an invention by another of a machine, manufacture, or composition of matter, makes valuable discoveries ancillary to the plan and pre-conceived design of the employer, such discoveries inure to the benefit of the employer. And the principle applies to the case of principal and assistant engaged in the work of a common employer, as these parties were (Braunstein Holmes, 30 App. D. C., 328-331; Robin (Braunstein v. v. McCormick, 29 App. D. C., 98-108) But as said in the last case cited:

"To claim the benefit of the ployee's skill and achievement, it is not sufficient that the employer had in mind desired result, and employed one to devise means for its accomplishment. He show that he had an idea of the means to accomplish the particular result which he communicated to the employe in such detail as to enable the latter to embody the same in some practical form

The Patent Office Official Gasette briefs

the case in its syllabus, as follows:
"D was employed to improve upon the magnetite electrode of S. He made sev eral different combinations of material, one of which contained 3 to 12 per rentum of titanium oxid. L was em ployed to sasist D and mived fired and tested the pencils according to his direc tions, but was not called upon to advis or assist him in any other way. While doing the work L conceived the idea of an entire or substantially entire reducpointed for the same time, at the same illon of the oxide to iron. Held, that this place. The superfluity of the separate did not inure to the benefit of D, clause organization has become very apparent. It was not a more mechanical improvement of the thing L was employed to code is the revision of the laws relating perfect."

of Enterest to Thermonics.

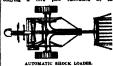
Of Interest to Thermonics.

O. J. Nimark, Washkeen, Wash. 25 control to the methic to struction.

obstruction.

AUTOMATIC SHOCK LOADER.—Alynum
RILLSFROM, 11142 Michigan Avenue, Chicago.

Iii. The investion shown in the engraving has
in view a machine adapted to load the shocks
while continuously traveling and embodying a fork pole fulcrumed at the



front of the track to swing both vertically als laterally, and directed in its movements by downwardy and outwardly-inclined guide hav-ing guide arms at the top extending to the opposite sides of the truck, a switch being ar-ranged at the fork of the guide to direct the pole into either of the arms.

Of General Interest.

nyrrang or use suip, and reduces the danger of ris.

JOINT FARIKNER.—D. A. Wasumx, Ban Antonio, Teas. This fastoner is adapted for servens and is provided with arms, with out that when the arms are pulsed inwardly in korfs in a member of the frame of the screen, the testh will be presend in the direction of the plane of the arms, the resiliency of the material of which the arms are made, forcing the member of the frame of the screen, the testh will be presend in the direction of the highest of the arms, the resiliency of the withdrawal of the frame and to prevent the withdrawal of the arms. The fasterner bead, which is secured to the arms, its disposed in a herr and provided with fastings with cutting edges, which provide means to hold the two

members together.

BOOK COVER.—O. H. BECKET, Believille N. J. The invention relates to improvement in removable covers for books, magazines, or the like, and more particularly to means for supporting and securing the book within the cover. The main object is to simplify the construction, so that the cover may be very inax-prastively manufactured, but will prove most that the construction.

inexpensively manufactured, but will prove another than definition to substantial and sufficient to use. BOILER DISINGEIPRING COMPOUND.—
B. L. D. GUYANA, VER CERS, Medico, Audien C. Audien C. Audien C. Audien C. Audien Compound which prevents the accumulation of scale or other increasting contings in boilers to provide a compound the neutralizing effect of which is calculable and may be added to writer cassumption thereof; and to provide a compound, simple and non-destructive.

GRAYE BRACE.—A. H. HAYARD, Urbans, III. Mr. HAYARD, the caving in of the early allowed another caving in or the early allowed agreement of the caving in of the early allowed agreement of the caving in or the early allowed agreement of the substantial control of the caving in or the early allowed agreement of the parts and simple formation which is particularly adapted to prevent the sides of the grave failing in.

CABINET.—K. MANTEN, Eastle, Fig. 10.

sides of the grave failing in.

CABINET.—K. MANTEN, Eastin, Pia. In
this instance use is made of a casing having
removably disposed thesets a plumitity of
drawers provided with revolutie means, for
containing essentederly had adapted to be revoired when the drawers are withdrawn from
the casing, and the hotiouss of the drawer
being substantially hinged, to permit of zewle-

in open position.

PIPE COUPLING.—I. Marverye, Newburyport, Man. The alim in this case is optioned us without liability of costs
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and accurate booling ingenties of the compiler.

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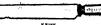
BED AND POWL PRECIDE.

BED AND P

REMOVABLE CALE FOR HORSMERORS.
H. D. WERDT, Hoboken, N. J. The calls-bearing plate engages with the shoe to prevent an interest movement of the plate, and is cleaned over the hoof in such a manuer first no per lateral movement of the pists, and is each over the hoof in such a manuer finit-had tion of the clamping means comes adjucts rear and tender side of the hoof. The proper are removable from the piats, and he readily replaced when worn or health

be readily replaced when wom or hevken. NECK YORD CHNTER_N.M. MARKE, LC Core. Cal. The baventine privides an ex-constructed from pitishic sized desdessing torial; provides as grojel: so made that anti-ratting material may be readily re-justed or replaced; and provides a loop the cyrie's adjustable to contrast or expand-accommodate neck yokes of different diames.

KNIFE.—Hanny E. CHARDLER, Rogers' Hotel, Minneapolis, Minn. ilustrated is for use in cutting ster and other meat or food stuffs, raw and other meat or food stuffs, raw or for scaling fish, for separating feeh of from the bones. for from the bones, for separating small and ligaments of poultry, etc., and are so that the use requires litti tion to quickly and properly phy



result divired. Use is made of a tooth togral with the krifs blade at the feweral and extending in the plane of the blade, tooth having its point arranged within straight cutting edge of the blade, this being interrupted for a short distance on sides of the toeth.

HOSE COUPLING .- H. W. P.

HORE COUPLING.—H. W. Permanou. Stat. Inc. Wash. The sain here is to provide a construction in which one of the coupling members will be provided with a packing arranged to be actuated by the pressure of the field within the coupled pipes in such manner as the coupling of the provided with a packing arranged to the saint of the coupling of the provided with a packing of the provided with a packing of given without The aim is to simplify the coupling of the provided with the provided with the colon in position, and to facilitate the



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CLOCKING DEIES.—G. R. HOWELL, South-campton, S. Y. This invention relates to chapter deliver or ruch, for hanging up gar-saints on other articles to day, or for display, sight her redevene more particularly to a de-vise of this clean, comprising a poet, a spindle control thereby, a hear creately as a spindle open the spindle and sected at the top of the popt, and hereally extending a russ curried by the control thereby the control of the control of the popt, and hereally extending a russ curried by

Special, Arenus, Newark, N. J. This irrention reliefs to spiritoon, water closet, refuse cana, and the like, and its object is to provide a recipitate with his sanitary and which may be conveniently employed. For the purpose menimed, we is made of a shell provided with a



RECEPTACLE.

heasher for containing formaldehyds or other inferients, and a receiving cup arranged in se shell and having its upper end adjacent to be inner well of the chamber so that the specy atteing from the distincting contents of them come in contact with and destroy waste or doors from the cup. CAN OFENER.—Dor P. Rarnaurs, Graham, C. The invention poliured between the received companied, and every some particularly to a companied, and every some particularly to a companied of the contract of the contract of the series of the contract of the contract of the series of the contract of the contract of the series of the contract of the contract of the contract which is the contract of the



mounted upon a frame and a rolling cutter mounted upon the carrier and serving to sever the material of the can or other receptacle. The invention also relates to a can opener in which the cutter-carrier is provided with fixed cutter-plade in addition to the rolling certar.

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the a gate which will be lifted by the cape as it approaches the gate, will hold the gate spen while at the Soor, and which will re-seare the gate as the Soor is passed, and wherein the gate at any door may be passed without opening the sme, it desired.

issue the gate as the foor is passed, and wherein the gate at any foor may be passed without opening the same, if desired.

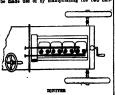
BOX_SRID—I.R. CLAIRO, Lordin, Ohlo. Box of the same and the sa

Viode nov distincting oysters and shells from the initial operation or resurcial from and to the initial operation of resurcial from and to FAM.—W. F. Printers and H. R. Bass, Morcian, Neb. The invention here is to produce a device adapted for use in harber shops, beauty parlors, etc., which may be held in the hand and manipulated about the face and half for drying the same, and which may be operated assert of injury to the present the standard and the same and which may be operated assert of injury to the present the same and the s

balanced.

VENDING MACHINE—C. F. Crass, Frantier, Ind. An object of this inventor is to provide a device in which the release of the sarcial to be remoid is accompled few marked to provide a device in which there are a plurality of stacks of articles to be vended with means for feeding an article from the bottom of each stack successfully, so that the hadget of the actual to the provide a device of articles to be vended with means for feeding an article from the bottom of each stack successfully, so that the hadget of the stacks will be appreciatedly the same.

Prime Movers and Their Accessories.
IGNITER.—ELECTRIME P. DU FONT, Montchanks, Del. Mr. Du Pont's investion is an improvement in imiliters, and in the construction pictured in the illustration, each cylinder in provided with two plugs and either set may be made use of by manipulating the two han-



and by closing the valves of the set not in use, such set will be perfectly protected from the products of combustion, and from the intense heat of the combustion chamber.

Intense heat of the combustion chamber.

**ALVE GEAR OF INTERNAL COMBUSTION EVALVE GEAR OF INTERNAL COMBUSTION ENGINEE.—F. W. LANCHASTER, 53

**Raigier Road, **Registation, Warrick, England, This invention relates to improvements in raive gear oil internal combustion origins, and raive gear oil internal combustion origins, and raive gear and method of control of valves of the eliding type specialty applicable to engines employing the Otto cycle. The object is the application of a variable cut off to the intake of the working fluid in an effective manner.

MARINET.

SPERADER RARS FOR TRACTION ENGINE HITCH—I. J CHARDONNET, Washen, Minn. This invention provides "Seas for consecting the hitching cables of grading machines to a traction sugine, whoreby the machine may be maintained in operative position at the opposite sides of the road while the traction engine travels in the center, and whereby the laterally extended ends of the whereby the laterally extended ends of the contract of the ground.

tion to the surface of the ground.

SEPARATOR.—B. W. KITCAIR., Wilson, N. C.

This invention has reference to improvements in separators and it is especially designed to be used with automobiles and gasolene engines for the purpose of separating the injunctives, thereby leaving the latter purs.

ELECTRIC RECIPROCATING ENGINE—WILLIAM A. STEDMAN, Millers, Nev. The improvement illustrated by the engraving, has among the principal objects in view: To provide means to operating a the without provide means to operating the substitute of the control of the contr



ELECTRIC RECIPROCATING ENGINE

vidual tamp bars may be independently oper-ated, repaired, or replaced; to provide electric engines for the operation of the tamp hars constructed to facilitate ventilation and heat radiation; and to simplify and economise the construction of stamp mills.

CONSTRUCTION OF MALED MINIS.

INTERNAL COMMUSTION ROTARY ENGINE.—FRED S. WRIGHT and ARRINGN F. WRIGHT, SI S. WRIGHT and ARRINGN F. WRIGHT, SI S. Grant Avene, Taccoma, Wash, In this patent the invention illustrated herewith has reference to internal combustion rotary engines. An object is to provide a



Weehawken, N. J. This improvement provides a condenser having parallel walls arranged to a condenser having parallel walls arranged to form a tortuous passage from linet to outsit; provides a condenser formed from parallel sheets of material arranged to form tortuous passages for gases, provides an air passage therethrough to sircool the insur of said sheets; and provides means for distributing and dissipating gases as the same are admitted to and delivered from the above mentioned tor-tuous passages. tuous passage

thous passage
PIRSH ROD: YOR DELIVERY VALVES OF
INTERNAL COMBUSTION ENVINES.—P.
KROY, T Ro. Collange, Levalide-Frerts, Belan,
France The invention consists in a push-rod
or pluager for operating a delivery view arranged in such manner as to avoid clearance
able rod serves to operate the view and is di
vided in two parts which are maintained constantly applied on the valve rod and the operating valve by means of a suitably arranged
applied, the contact leathers the two parts of
the push-rod being effected within a closed
between the counted suffaces by displacement
of two parts of the push-rod.

Railways and Their Ac-

Ballways and Their Accessories. METAL TIE—Adducting B. Caron and Easter A. Cartes, Canden, Texas. The tie shown in the accompanying engraving is an all-metal tie to take the place of the wooden ties now in use and gives the same resiltence with increased durability. An object of the invenional control of the invenion of the care of the care



tors is to provide a tie which will be inex-possive to manufacture, and with which it will inc difficult for the rails to appred or to be impered with. A futher object is to pre-vide a railtond the lawing a connection with the rails, such that the latter have a limited vertical movement resisted by resilient mem-bers.

Pertaining to Recreation,

Pertaining to Recreation,
PUZZILE GAME BOARD——It. RIVISION,
New York, N Y The object here is to connect certain of the spaces of the continuous
and the spaces of the continuous
spaces, by other centres in history or central
space, by other centres in the continuous
spaces to the continuous continuous continuous
spaces to an adjacent turnovered spaces were the
connecting course.

concer to an adjacent unrovered space over the connecting courses M FOV, Thatks, Fig. That improvement refers to vehicies for use with agricultural implements and other perposes, and has reference more particularly to an automobile while comprising a wheeled of the frame to proved the vehicle, and head operable independently of the driving wheels, to propel the vehicle, and reference to the control of the frame to proved the vehicle, and the second of the frame to proved the vehicle, and the second of the frame to proved the vehicle. The frame to prove the vehicle and the first the provided of the frame to prove the vehicle and the first the vehicle and has for its object to provide an elastic tire of great strength and durability and that may be readily and easily reported The war and tear on this tire as constructed is only and hollow bodies injured has to be removed and repaired or replaced by others.

WAGON STAKE—II. Wears and II Weats.

and repaired or replaced by others
WAGON STAKE—I. Wast and II Westa,
Medford, Wis This invention relates to
wagon stake, and has reference more particularly to a device comprising a base, means for
firmly securing the lasse to the holster or to
another part of the wagon upon which the
stake is to be mounted, a socket, and the
stake proper, removably secured in the socket.

Designs.

Design Por A VARE OR SMILAR ARTICLE of Zaroans. Limogor, France. In this design for a vase or similar article, the front and the back present entirely different designs. The side portion has a shield on one taking the side of the property of the side of the si



Kindly keep your morrise on separate sheets of paper with a curresponding about such matterials are analysis of the separate subscriptions, books, etc. This was parent in cultilate answering your good-former of the separate for the separate for

small, it may be dippled into the solution. The pintulac chlorids can be spirchased from dealers in chemicals. There are a number of other good methods, some of them cheaper than this, to be found in our "delentific American Cyclo-pedia of Formulas," just out of press, which we will send for 55. (12486) W. L. A. says: Referring to

juedia of Fermulas," just out of press, which we will end for 65.

(13465) W. La A. anya: Referring to your issue of March 4th, 1931, page 123, allustian is made to a "medium perseaded to above ""Nee is word to be a "medium perseaded to above ""Nee is word to be been insulated in question was written for the purpose of imparting information to your subscribers, in which case would it not have been "medium," and add also that of the best "insulators". The subject may be of much interest to those of your readers who ere a situated into they do not have access to well-equipped interiors, and would like to Will you Mindy six to these of your readers who ere an itsusted into they do not have access to well-equipped interiors, and would like to Will you Mindy six to the titles of works which contain the details of such "medium," and "insulators" as those referred to in the article ansued? A. We are quite willing to supplement the attounant of the surface of packed to the place that the surface of the surface of packed to keep the heat in, but admits the heat of the sum or a bottle is constructed. Would see heat to keep the heat in, but admits the heat of the sum or a bottle is constructed. Would see heat to keep the heat in, but admits the heat of the sum or the principe of the attention, absects and magnetic results of the sum or a surface of packed to keep the heat of the sum or a bottle is constructed. Would see heat to heat of the sum or a surface of packed to keep heat his, since they are excellent insulators indeed. We was wone to be the lamber of the sum or the principe of the sum or the p

It may be doubted if our correspondent thought in ribor mercitors those things:
(12467) R. K. Pr. asks. To settle an argument will you please publish in your and that when sir is compressed its temperature rises? The party maintains that during compression friction is set up between the molecules of which air is compaced. The other issues of which air is compact the other properly speaking, between molecules of a gas, and that the rise in temperature is directly due to the shortening of the free path of the best of collisions between them, each collision setting up a wave of best A. The heat generated by compressing a gas is due to the greater number of collisions in the gas from shortening the mean free path of the molecules. Friction has little heating effect upon a gas.

(12468) T. C. F. ankir. In your issue of April 20th, page 331, you give table of star distances, etc., in which appears, "Polaris distance in light years "0 and Vaga 35". In Prof. C. A. Young's "Manual of Astronomy," edition of 1000, hage 857, & & depreyer's calculations in recent years to account for three immense changes in distance? A. The table of the distance of the property of the control of the distance of the (12468) T. C F. asks: In your issue

could see them change their places with reference to each other as the year advances. By minute measurements carried on for many parts, certain of the siture have been found to have been could to be the siture of place required by any control of the could be the siture of their required by any control of the siture of the siture of the could control to the hand of the carried of the siture of the siture of such a motion of the cart in this way the distances of from fority to fifty stars have been determined in the last was hundred years with the siture of the siture of the could be situated by a siture of the siture of such a motion of the cart in the such as a present of the situation of the s

NEW MODES, 270.

nent Church, Editor of the Army and Navy Journal Sve.; 257 pp. Nov-York: Charles Sorthuer's Sonn, 1811. ce. \$1.50.

Navy Journal. Swa; 257 bp. Nyew-York: Charles Sertiness* 30000, 1931.
Perico, \$1.50.
The lives of all great single-sers one full of interest and that the state of the state o

ilfo, are numerous and well chosen. We give this work a hearty recommendation.

THE CONSTRUCTION AND WORKING OF JR.
E. Mathot. New York: D. Van Nostrand Organization Company, 1910. See, 546 pp.; Illustrated. Price, \$8 net.

The translation from the Further to the requirements of American and British readers, certain descriptions of little-known types have been condemned or control disapether, and all the material has been grain-material processing the property of the proper

TENTING OF ELECTRO-MASSETIC MACHINERY AND OTHER APPARATUS. By Bernard Victor Swenson, E.E., M.E., and Budd Frankenfield, E.E., assisted by John Myron Bryant, E.E. Vol. II. New York: The Macmillan Company, 1911. 8vc, 324 pp. Price, \$2.60 net.

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securing the content of the same of the same securities according to the content of the content

DUSTMAN'S BOOK OF PLANS. Chicago: The Charles C. Thompson Company. Price. \$2.

Price, 32.

Turning the passes of this book, we finel plans for one hundred and fifty modern house, bungalows, and burns. In addition is a great deal of information not generally finely for the passes of the pass

over The work is well printed, and illustrated in the problemer used profigula manner.

TERTING OF ELECTROMAGNETIC MACHILING TRANSPORT AND OTHER APPLANTUM. BETWART AND OTHER APPLANTUM. BY BETWART VICTOR SWEEDON, E.E., WILL. II.

New York: The Macmillan Company, 1911. 8vo; 334 pp. Price, \$2.60 net. 88; years have been allowed to slapse since the publication of vol. 7, desiling with direct-current electromagnetic machinery and spite and profit of the authors that alternating-current theory was to rapid that any published experiments and cobservations would soon have been outlean and of little practical use. Now, however, it is the benefit of the authors that alternating-current door was to rapid that any published experiments and cobservations with the profit of the authors that alternating-current door was to repet the conjugate of the profit of the authors that alternating-current and of little practical use. Now, however, it is the benefit of the authors that alternating-current of the conjugate in the profit of the authors that alternating-current of the conjugate in the profit of the authors that alternating-current of the conjugate in the profit of the authors that alternating-current of the conjugate in th

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F., Bot 7th. Rew York.

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The Land Control of the Control of t

Wiscrepouts.

(Consisted Irwa sees Sh.)

forsado is aspiled specifically to the particularly violent landspouts that are common in certain parts of the United States.

We have seen that dust whiris occur only when the surface of the ground is only when the surface of the ground is often beautiful and the surface of the ground is often beautiful and the surface of the lower six. The sharp out included the process of the lower six. The sharp out to tamperature that produce them are characteristic of a land surface as compared with a water surface; yet it so over the latter that spouts are most frequent. Here, then, is one point of difference between the dust whirl and the spout. Another is the fact that no surface inlow of the air is observed shout a spout, except immediately within it. A waterspout immediately within a few hundred feet of a vessel when the latter is absolutely becaused. Both of these circumstances prove the inaccuracy of the common statement that goots are due to an undestinest surface. earth's surface.

Both theory and observation indicate

eartin's surface.

Both theory and observation indicate that the vortex of a spout originates at that the vortex of a spout originates at the vortex of a spout originates at the vortex of the surface of the middle or lower clouds—and is thence propagated downward. The explanation of its origin must be sought in the contrasts of temperature occurring, at high levels, on the margin of a large cyclone; the sone in which spouts originate being identical with that in which squalis (vortices with horitontal axes) are also most common, horitontal axes) are also most common, or other observed dangling from the clouds, with no agitation of the water beneath such as would indicate that the vortex actanded to the lowest stratum of the air.

Waterspouts are common within the Waterspous are common warms tropics, especially in the equatorial region of calms and baffling winds known as the "doldrums" The East Indies, the Culines coast, the Red Sea and the Mediterranean are some of their favorite

charmasan are some of their favorite haunts.

It is hardly necessary to state that a waterspout does not consist of court, in the ordinary sense of the term. A vortex in the ordinary sense of the term. A vortex in the content of the term of the t

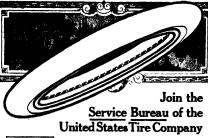
ying beyond the about, can be distinctly seen through it.

Although the vortex, and the resulting visible column of mist, grows downward, the air in the spout moves chiefly upward, in spiral paths, otten with force enough to carry heavy objects aloft, as is command: asset in the terraddown.

enough to carry heavy objects aloft, as is commonly seen in the tornado.

When a waterspout suddenly breaks, owing to a cessation of its vortical motion, its moisture may be discharged downward in the form of a torrestail rain. This has sometimes happened over a ship, and the water was observed to be formed to be seen as sail, proving that no conference of the water was observed to be formed to be seen as sail, and the water was constituted in the seen of th

This COLUMN CARBUTLAT. Two with make the comment of the control of



Learn how to reduce vour annual tire bill

THIS Bureau has numurous or letters from motorists telling of tire mileage ranging all the way from five or six thousand niles up to twelve thousand. These motorists up to twelve thousand. HIS Bureau has hundreds of miles up to twelve thousand. These motorists enthusiastically give all the credit to the better quality of United States Tres—

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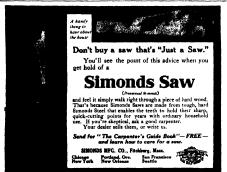
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south of Seal Rocks and gains south we saw before us a waterspout in the midst of a black and heavy looking rate with it looked like a bright funnel and the tube descended to the sea, which it implet into a ferce withrined.

tibb descended to the sea, which it issues into a ferce whirlpool.

The spout was traveling to the northwest and passed us three-quarters of a mile to westward. I estimated the speed it was traveling forward of about verieve to fifteen miles per hour. The second one was not so harp, hat otherwise very similar on the period of the control of the cont the same direction. The third and last one was very beautiful; it formed under the southeastern extremity of the very dark rain cloud, and it traveled in the dark rain cloud, and it traveled in the same direction as the other two. Its hours of the same of the control of the same of twenty miles per hour, we could see it wery well. As it came bowling along at the rate of twenty miles per hour, we could see the water spouting up in a continuous and uniform stream right up to the cloud.

cloud.
When the watersport was about two miles to the northwest of our ship it suddenly presented a very curious and fantastic shape; it became very long, swaying and coiling about like a serpent. All at once it made a complete coil (see illustration), then burst, great quantities of water poured out of the lower part of the coil, and in a feeter than the contract of the coil and in a feeter than the coil of the coil and in a feeter than the coil of the coil and in a feeter than the coil of the coil and in a feeter than the coil of the coil

had never been in existence."
If mariners were once a prey to a superstitious dread of waterspouts, on the other hand the sailor of to-day is perhaps inclined to go to the other extreme. Sea explains have been quoted as saying that they would not be afraid that they had sevir seen. There are, however, several cases on record in which vessels have come off much the worse for inseveral cases on record in which vasses have come off much the worse for involuntary encounters with waterspouts. In 1895 the German bark "Ceylon," Capt. Niemann, bound from Antwerp to Philadelphia, met a waterspout in about 31 deg. north lat, and 71 deg. west lower.

shout 31 deg. north lat, and 71 deg. west long.
Most of her canvas was furled at the time, as she had recently encountered a thunder squall, and hence it was not possible to sail out of the way of the spout, when it was seen rapidly approaching. The spout struck the vessel on the port side, and heeled her over until the starboard yastername often she was swung around from north-northwest to south-southeast, and then thrown over to port, on her beam ends, with such violence that her minimums and missemmast went. that her mainmast and miss

by the board.
On the coast of Guines, in 1874, a sixteen-gun man-of-war of 300 tons was similarly mishandled by a waterspout, losing her foremast and bowsprit in the encounter.

The Paris-Rome-Turin Aeroplane Race

(Contiwed from space 669.)

that he abandoned the race at this point. that he abandoned the race at this point. Bathiat reached Lyons the evening of June ist, after having had another breakdown. Lieut. Luces, while fying from Avignon to Nice on June lat, was forced to alight at Hoperes, near Marsellies, owing to a thick fog. The next morning he made a fine start and few over the city, but returned shortly after in order to adjust his motor. Just as be was about to alight his Henry Farman biblians usued. When the variator and biblians usued. When the variator and

was about to alight his Henry Farman biplane upset. When the aviator and his passenger were removed from the wreckage, it was found that each man had a broken leg.

The race to Rome was notable from the fact that two aviators, at least, made the trip in record time, although they suffered various midshaps and meter breakdowns. The endurance of these sens, as well as of their machines, must have heave years in order to stand so

was killed recently by a substant current under greature of \$300 Every effort was made to resembles man, but after physicians had don impossible to restore him, by life, impossible to restore him for Me. Fort. Silbit Thomson, who happened the bresent, with the assistance of Der George R. Woodville, endeavour to estimate heart action by subjecting the man to a current under 50,000 volta passaure. The experiment was eventually given up after a number of charges failed to produce any signs of life. impossible to re

Electricity and the Growth of Children. Electricity and the Growth of Children.

—At the suggestion of Prof. Swante
Arrhenius, an experiment is being tried
in Stockholm upon fifty echool children.

The children are divided into two groups
identical in point of health, height, The children are divided into two groups identical in point of health, height, weight, etc., and are placed in two class rooms of the same dimensions, and simularly situated as regards exposure to light. In each class room, exacely the same teaching is given, but one of the class rooms in subjected to sietricity, while the other is not. As yet the experiment has not been drawn to a dlower periment has not been drawn to a down and the children. There shown a greater mental and physical development than those in the other class room.

Test of Electric Automobiles.—On June 6th a very interesting contest of electric automobiles will be conducted by the Electrical Automobile Dealers' Association. The object of the contest is of demonstrate the value of the electrical demonstrate the value of the electrical automobile for visits to suburban towns and for shopping trips. The entrants will start from Columbus Circle, New York, and make a trip on Long Island of from 90 to 70 miles on a single charge. An average speed of about 12 miles per school to 10 miles on a single charge. An average speed of about 12 miles per school to 10 miles on a single charge. Island to 10 miles per school to 10 miles per exact schedule time allowed will be kept secret, and when the contest is over those whose time happens to be nearest to that of the schedule will receive prizes.

to that of the schedule will receive prises.

Electrical Lock Gate Machines for
Panama.—Plann for electric machinery
to operate the locks of the Panama
last of the lock gates with believed
by a separate motor, and in addition
there will be a miter-locking machine
operated by a separate motor, to lock the
leaves together. Each leaf will be connected by a connecting rod to a "buil
wheel," or crask wheel, which may be
moved through an arc of 197 degrees by
a train of garing driven by the motor,
a train of garing friven by the motor. a train of gearing driven by the motor.
The "bull wheel" will be 19 feet 2 inches in diameter, and will be mounted horizontally on the lock wall, being supported at the rim upon rollers. The connecting sontally on the lock wall, being supported at the rim upon rollers. The connecting rod will be provided with a shock absorber to withstand wave action and the like. The operation of swinging a leaf open or closed will take but two minutes. After the leaves are closed they will be locked by means of a pair of jaws on one leaf said a pin on the other, which will be seized by the jaws under action of the miter-forcing machine.

action of the miter-forcing machine.

Destroying a Wooden Reidege by Riesticity,—An interesting use of electricity was recently demonstrated in Ranghand, were as the electricity was recently demonstrated in Ranghand, where the electricity was been electricity being the result with the electricity and the reiden was to be replaced by a steel structure supported on the old masoury piers and abutments. Three weaks was allowed in which to dismantie the woodwork, but it proved impossible to accomplish the work in so short a time without the use of dynamite or fire, which undoubtedly would have injured the masoury. Finally an electricity proposed to destroy the bridge by the use of electricity. Bach upon of the bridge contained treatly-seven plants, and it was proposed to out them so that they would drep into breakdowns. The endurance of these seen, twenty-seven pinals, and it was proposed as well as of their machines, must have to been very great in order to stand so the water simultaneously, clear of the been very great in order to stand so the water simultaneously, clear of the water, interspersed with heavy land-ings in dasportup place. M Gerror was sufficient current was employed to bring lings in dasportup places. M Gerror was apparently in very peer physical condi-floor ministee after the current was apparently in very peer physical condi-floor ministee after the current was apparently in very peer physical condi-floor ministee after the current was apparently in very peer physical condi-floor ministee after the current was apparently in very peer physical conditions of the condition of the current was apparently in the condition of the current was apparently in the condition of the current was apparently in the current



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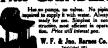






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Science

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Meastiving Bullet.—In an address to the Parita academy of Sciences, Frof. Belthasard contends that when a leaden bullet traverse cloth, characteristic marks are left upon it, witch are not obliterated by the subsequent passage of the bullet through fiesh, provided that it does not strike a bone. It is even possible, he claims, to identify the nature of the garment through which the bullet has passed by a careful examination of the marks on the lead

on the lead Tesh of a Second,—It is not common to find a person who can correctly estimate the lapse of a single second. But, in these days of speeding automobiles, the exact time when each of two colliding vehicles must have occupied particular spots may be a matter of great importance. In a recent experiment a car took nearly two seconds to stop after brakes were applied, and in that time it moved inhesten feet. So even fractions of a second are important. One can train himself to estimate even tenths of a second. Try it with a watch, and it will be found that it is just possible to count io in the lapse of a single second. But one must count very fast to do it.

Count very fast to do it.

Cotton in France.—It is desired to promote cotton raising in the French colonies so that France will not be obliged to import its supply. At present it imports 250,000 tons valued at over \$60,000,000 Two-thirds of the supply comes from the United States, and it is evident that there are many reasons why the supply might be cut off at any time in the future, either on account of a crisis or from the fact that all the cotton would be used in America, henre the need for taking some measures in order to reverence that the Attention of the colonies by allowing subsidies for this number of the colonies by allowing subsidies for this number of the colonies by allowing subsidies for this number of the colonies by allowing subsidies for this number of the colonies by allowing subsidies for this

purpose
Largest of Flowers.—The largest of all the flowers of the world is said to be the Raffesia, a native of Sumatra, no called 'stref' 'Sir' 'Stamförd Raffes. This immense plant is 'ömposed of five round' petals of a brickish color, each measuring a foot across. These are covered with aumerous irregular yellowish white swellings The petals surround a cup nearly a foot wide, the margin of which bears the stamens. The cup of the Raffesia is filled with a fleshy disk, the upper surface of which is covered with projections dike miniature cows' horns. The cup, when free from its contents, will hold about twelve pints. The flower weighs about fifteen pounds, and is very thick, the petals being three-quarters of an inch.

an inch.

Protection from X-Raya.—In order to protect operators against the harmful effects of X-rays, Dr. Authorst the form of the body. On the head is a rubber protector somewhat resembling an ancient armor helmed. A pair of glasses covers the eyes, and the glass used here is a kind of lead glass which is found best to act as a screen. The operator wears a hiouse or apron which is lined with thin sheet lead together with rubber and bismuth. On the hands are worn thick gloves having a like protecting covering. Such armor is not always needed, but can be used by dectors who are much affected by the rays or who are aiready injured by them.

Cold Storage in Europa.—Many of the

are aiready injured by tasm.

Cold Steenge in Europa.—Many of the
European cities are following the example of America as regards cold storage plants. Paris is one of the centers
unced, and the Refrigeration Society is
andesvoring to bring such question before engineers and manufacturers. Not
long since there has been built a large
cold storage plant in the suburbs of
Paris and lying on the North railroad.
It is designed to store home preducts
which are to-be exported, as well as foreigs products brought in by rail to be
consumed in the city. There are now
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The test of a magazine's merit

is that its readers tell their friends about it.

We recently asked our subscribers to send us the name of those whom they believed the Scientific American would interest, and we are gratified to find that so many of our subscribers believe that its merits will appeal to such a large number of their friends. Have you sent a list? If not,

Here is the way:

Simply send us the names and addresses of the people whom you think will be interested and we will do the rest. An accurate record of all names received in this manner will be kept, and for each new subscription we get from any list we will extend the subscription of the person who sent us the list for four months. Thus if we receive three new subscriptions from any one list the subscription of the person who sent us the list will be extended for a full year.

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Railroads of a Co

THE JUNE MAGAZINE NUMBER OF THE SCIENTIFIC AMERICAN ISSUE OF JUNE 17th, 1911



Transportation facilities and civilization go side by side—a people's means for getting about give a pretty good line on their development in other regards. For this reason, among others, we are devoting the greater part of the June mid-month number of the Scientific American to the story of that marvelous network of railroads, which, during the past three-quarters of a century, has een woven over the face of the United States and Canada.

In bygone years, there was much cau for the hostility of the public to the

iblic camien; but condi changed for the better. To-day there is no reason why the public and the restroads should not settle down into an attitude of friendly co-operation. This at least, is the conviction of the Scientific American, and it is shared by Mr. W. C. Brown, President of the New York Central and Hudson River Railroad, who will contribute a characteristically clear and forceful article on this subject.

One-half of the railroads of the world are to be found in the United States, and, as usual, we have stamped our individuality strongly upon them. The most picturesque and romantic ele in our system is the half dozen great nental routes, which span that wonderful stretch of plain and me that lies between the Mississippi River and the Pacific. The story of the transcontinental roads will be sold by Mr. William E. Hooper, Associate Editor of the Railway Age Gazette.

Let it be understood that the above articles will be metter additional to the regular paper, which will contain the usual editorial, aviation, science abstracts, inventor's and other weekly depart-

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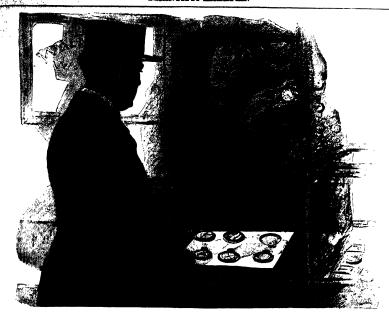
The Application of Aerodynamic Theory, with omplete Description and Compar-ison of the Notable Types By GROVER CLEVELAND LOENING, B.Sc., A.M., C. E.

CRITICISMS

"A very complete account of the theory of heavier than are fryag machines worth a technical description of nearly all the present types of aeroplanes. ... Presents in compact thap a seroplanes. ... Presents in compact the substance of aeroplanes in the hottp. r. ... Easily comprehensible to the reader who can concentrate his lateoism. ... It is the most scientific popular book on the seroplane that we have come across to fail.

New York Sun. "Many wrears have failed to realize the demand which exists for zero literature in the demand which exists for zero literature in that the predominant part of a comprehensive expension of the entire subject. For a writer to stear a straight course between the masses of trigonometry on the one hand, and the superficulties of more discussion in a popular way of the comprehensive to the comprehensive that the comprehensive and the contract of the contract of the comprehensive and the contract of the comprehensive the mathematical assessphere as to present the whole subject from a broad standpoint, making it readily immiligible and internatives to the less.

The state of the s



WALTHAM is the pioneer railroad watch of America and the first officially adopted by leading railroads here and abroad. For years, Waltham was the only Company to construct a watch movement specially designed for railroad purposes.

RAILROAD watches, to pass inspection, must not only be time pieces of absolute mechanical precision, insensible to changes of temperature, climatic conditions and varying altirudes, but made specially strong and durable for the exacting Railroad service.

WALTHAM watches have stood the test of three generations of railroad history. For scientific accuracy they are unrivalled. They have been furnished to numberless scientific expeditions where time reckonings were of greatest moment, including those of Peary and Shackelton. They have also been selected by the United States, Canadian and foreign governments for survey and other scientific work.

WONDERFUL automatic machinery invented at The Waltham Factory insures a uniformity and precision in the manufacture of small watch parts impossible to obtain from the most skilled hand labor of Europe. This is a great factor in Waltham accuracy.

SCIENTIFIC care in the adjustment of Waltham watches is shown in the fact that The Waltham Factory has its own Astronomical observatory, equipped with transit instruments and sidereal clock, and maintains an independent standard of time corrected to the second's fraction.

ALL watches are not exposed to the exacting conditions of railroading; but it stands to reason that watch construction designed to meet these severe conditions will also meet the needs of every-day business, professional and social life with highest proficiency. Waltham Colonial, Riverside grade, in thin exquisite models, is an ideal high grade watch for the man of taste.

WALTHAM



Railroad watches began with "Crescent St.", for years the highest grade 18 size Waltham movement and still an old Railroad favorite. Successive improvements finally evolved the "Vanguard"—the foremost railroad watch in the world.

VANGUARD: Scrength, solidity and simplicity distinguish this famous model. While the frame of the ordinary watch movement is composed of seven parts, The Vanguard has but four. Other points of superiority are: the location and protected condition of the balance wheel; the use of the doubler oller, whereby escapement factors is reduced; the manner of securing the jewel pin in the impulse roller; the improved skeel tempered asfety barrel which secures the train of the watch against dangers otherwise likely to arise from the breaking of the mainspring. The Vanguard is made with 19, 21 and 23 selected diamond, fine ruby and sapphire jewels; is adjusted to temperature, isochronism and five positions.

CRESCENT ST. is a solid nickel movement and is made with 19 and 21 fine ruby jewels; adjusted to temperature, isochronism and five positions.

"It's Time You Owned a Waltham,"

Send for descriptive booklet. Then consult your Jeweler.

WALTHAM WATCH COMPANY, WALTHAM, MASS.





Electricity Assisting the Traveller



The many comforts as well as the speed and the safety of travel in 1911 are closely and yet inconspicuously allied with the applications of electricity. In fact, the average traveller is not always aware of the source of the very improvements which his appreciation and support has encouraged.



Irein Lighting



Electric Signals



Gas-Biectric Car B. R. P Railroad



Race between stram and electric locomotives on New York C.ntml



Railway Power House, New York Central

The steady, brilliant illumination which is supplied by current from a small steam turbine located on the locomotive or in the baggage car gives a homelike and cheerful appearance to the moving cars.

Speed and safety have been increased by electric signals which are operated automatically, giving infallible indications of track conditions for miles ahead of the speeding train.

Powerful electric locomotives are now used to haul steam trains through tunnels and up heavy grades, thus avoiding the obnoxious smoke and gases, at the same time increasing the speed and safety of journeys through mountainous country.

Branch lines to rural communities which do not transact enough business to warrant the expense of a steam train, are now operated by the self propelled gas-electric car. This car attracts the distant as well as the local pleasure travel, thus bringing the community into more profitable relations with the larger-centers.

The general application of modern illumination to picturesque falls, caves, municipal buildings, streets and stations along the route has contributed largely to the increasing pleasure in travel. Electrically equipped repair shops have greatly reduced the time required for repairs and have increased the efficiency of the system.

The approach to a terminal city is marked by cleanliness, faster service and an increasing number of commutation trains which are made possible by electrical operation.

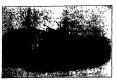
The efficient production of power in large quantities by means of the steam turbine and water power generators contributes to the extension of electrification of steam lines.

Wherever the appreciation and support of the travelling public warrants further applications of electricity, the engineers and equipment of the largest electrical manufacturer in the world stand ready to assist the railroad.

The apparatus shown on this page constitutes only a small part of the steam railroad equipment which is made by the



Turbo-Generator on locometire C. B. & Q. Ros



Blectric lecomotives on Great Norths



500 ton electrically driven press in regain shop



Dismination of Mingara Path



Becario train on the Pennsylvania Ratirosa

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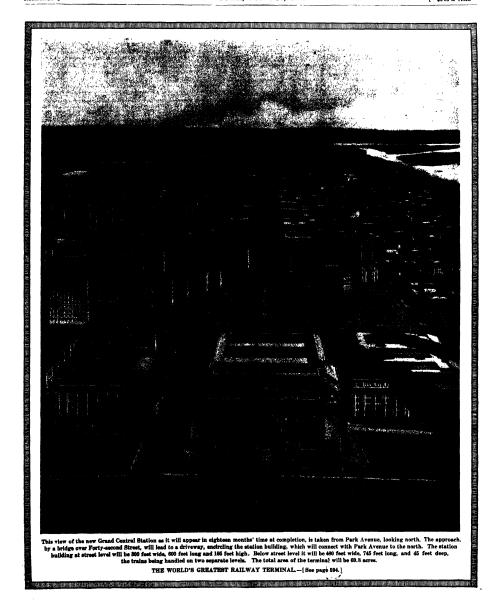
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Munn & Co., Inc., 361 Broadway, New York

The latter is always glad to receive for examination illustrated as the consubsects of timely interest. If the photographs are dury, the articles don't, and the facts authority, the contributions will receive special attention. Accepted articles will be paid for at regular space; this

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science,

The Steel Railroad Car

T is difficult to understand why that universal material of construction-steel-should have I made so late an entrance into the important field of American railroad car construction. For a given weight, the steel car is far stronger than one of wood; its period of useful life is much longer; it lends itself more readily to a concentration of strength in those parts of the car where it is most strength in those parts of the car where it is most needed, it is incombustible; costs less for up-keep; and, most important of all, removes forever from railroad operation those two frightful causes of death and injury in railroad wrecks—fire and telescoping of the cars.

scoping of the cars.

But when the age of the steel passenger car
finally arrived, it was ushered in on a scale which
reflects the greatest credit upon the Pennsylvania reflects the greatest creat upon the remayarama Railroad Company, to whose enterprise some tribute is certainly due in any article dealing with this most important subject. At the same time it should be recorded that while this company was the first to make extensive use of steel cars in trunk line express and local service, credit is also due to the express and local service, credit is also due to the Interborough Company which operates the system of subways through New York city for being, we believe, the first to use all-steel cars in passenger service. Limitations of space prevent any detailed description of the fine equipment which the Pennsylvania Railroad Company has placed in service, but in the current issue of the Supplement will be found an illustrated article dealing with this

will be found an illustrated article dealing with this adbject at some length.

Briefly stated, the principal advantages of the new construction are—first, the provision of a massive, longitudinal, box-grider running entirely beneath the center of the ear from buffer to buffer, to which are attached the couplings and through which are transmitted the heavy shocks incidental to which are transmitted the heavy shocks incidental to railroad service. Second, the provision of means for locking the abutting platforms of ears very firmly together so as to prevent one platform from mounting the other and acting as a knife to cut its way through the adjoining car in the process of telescoping. Third, the provision in this last connection of massive, vertical steel framing at the vestibula and the ear entrances, of sufficient strength vestibule and the car entrances, of sufficient strength to resist telescoping in case the platforms should overlap in collision; and, lastly, the complete elim-ination of wood and other combustible material so as to shut out the possibility of fire in case of a

The unqualified success of steel car equipment in The unqualified success of steel car equipment in active service has led to its adoption by several leading roads, including the New York Central, the New Haven, the Lackavania, and the Chicago Rock Island & Pacific, all of which are placing steel cars in service as soon as they are available. But in this connection we wish to utter a word of warning. In connection we wish to utter a word of warning. In a long, heavy, and fast train made up of mixed a long, heavy, and fast train made up of mixed steel and wooden cars, the very elements of strength and resistance to telescoping which render the car a protection to those who use it, make it a menace to the weaker wooden cars which may be sand-wiched in between. In case of a head-on collision the momentum of the train is expended in crushing up or splitting open the weakert element in the train. Hence it would be advisable, if a train is to be made up of both wooden and steel cars, that care to be taken always to place the latter immediately behind the locomotive

The Law of the Air

HE flying machine and the airship have brought us face to face with new legal probbrought us face to face with new legal prob-lems, that affect not only local conditions, but interstate and international politics as well. The first question that must be decided is this: Has the man any right to the atmosphere at all? air-man any right to the aumosphere at air: A me old legal maxim that a man owns not only the land upon which his house stands, but also the air above to unlimited height immediately springs to mind. Curious as it may seem, no square decision in which that maxim is involved can be found in all English or American law. On the other hand, there is many a deptim to show that the maxim is asthes. ism or American law. On the other hand, there is many a dictum to show that the maxim is rather lightly regarded. Master of the Roles Brett once referred to it as a "fanciful phrase." It is only when the possession of the soil is interfered with when the possession of the soil is intercrete with that the air-man is likely to infringe upon the rights of property owners. That point of view is taken in most of the European codes. Thus, for example, in the German Civil Code it is stated that a property holder "cannot prohibit such interference under-taken at such a height or depth that he has no inter-matic the "versation". est in the prevention

Probably the first laws which will be enac this country will concern not property, but lives. In view of some accidents which have occurred at Paris, it seems unlikely that sir-craft in Euror will be permitted to fly at will over large cities, and communities with the possibility of being compelled to descend because of crippled motors or lack of fuel. On the other hand, the open country and navigable streams will probably be free.

Forced descents may perhaps render it necessary to treat the air-man more leniently than is possible under the common law. In a New York case (Guille against Swann, 19 Johns., 381) decided in 1822, an aeronaut was held responsible not only for the an aeronaut was held responsible not only for the direct damage caused by the descent of his balloon into a garden, but even for the remote damage caused by the crowding of strangers upon the property to satisfy their curiosity. In an article which published last year in the American Journal of International Law, Governor (then Judge) Simon Baldwin thought it would be advisable to indicate where a landing is prohibited and where it is permitted. It seems to us that in the case of a more mitted. It seems to us that in the case of a necessary landing, the aviator should not be made to pay more than the direct damage which he has himself caused. Governor Baldwin has raised the question whether the law of self preservation cannot be invoked by an air-man who is compelled to make an immediate landing to save his own life and by so doing accidentally causes the death of another.

so doing accidentally causes the death of another. To avoid these forced descents, and to insure care-ful control of air-craft as far as possible, ligeages to navagate the air will undoubtedly be necessary. Most of the bills which are now pending before legis-latures provide for such hecense. In the United States it is questionable whether the States should be permitted to issue such licenses in preference to the Federal Government. When air-craft travel at speeds of 40 to 80 miles an hour, it is to traverse more than a single State in a day. Must the aviator take out licenses for every State in the Union? Would it not be more desirable to receive a Federal license which would enable him to fly where he pleased? To be sure, automobile hint to fly where he pleased: 10 of sure auconomic licenses granted by one State are respected for a few hours in most States. But the conditions in the air are so different, the distances covered so great, that a similar provision to protect the acronaut would mean the practical nullification of any State's would mean the practical nullification of any State's heense act. Moreover, if the Federal Government controls the licensing of steamboats and ships that ply our coasts and streams, why should it not also license air-craft?

Questions of aerial international politics have already given Congresses which have met in Europe no little concern. On the whole, there seems to be no little concern. On the whole, there seems to be a tendency to apply the principles of maritime law to air-craft. Thus, before the American Political Science Association, Mr. Arthur Kuhn suggested that the right of the craft of one nation freely to trathat the right of the craft of one nation freely to tra-verse the airspace of another might be compared with that of the vessel of one State freely to mavigate the waters of a co-riparian State. The abortive convention drafted by the International Conference on aerial nevigation of 1910, was based entirely upon the provisions of International mari-time law. There are the same requirements as to registration and nationality of the air vessels; the same method of determining the fitness of the craft, and the competence of its navigators, and the same ragulations applying to the sojourn of sili-craft in distress. Provision is also made for this recepting of logs, customs super-rision in the stanespiece, the right of police, the regulation of passenger and freight traffic, the prohibition of navigation in certain in the vicinity of fortifications. There is even a tendency to incorporate a principle analogous to the three-mile neutral some of maritime law; but there seems to be no agreement on the height of that some as yet.

Renaissance of the Naval Reciprocating Engine

Engine

WHEN it was recently announced that the
Navy Department had decided to return
to the reciprocating engine as a drive for
battleships, we expressed astonishment that this
should be done at a time when every other naval
power was using the steam turbine exclusively.
That the action of the Department was based upon
fact and sound reasoning, however, is shown by the
comparative steaming results obtained from two
sater ships, the "North Dakota," which is equipped
with turbine engines, and the "Delaware," driven
by standard reciprocating engines.
An opportunity for comparison of coal consumption under identical conditions was recently afforded
when the two ships were steaming with the North

when the two ships were steaming with the North Atlantic fleet, the "North Dakota" in position directly astern of the "Delaware." We are officially directly astern of the "Delaware." We are ometally informed that average results for ten days show that using coal from the same collier, employing the same auxiliary engines, and steaming at the same speed, of 12 knots, under identical conditions of wind and weather, the "North Dakota" consumed \$5 per cent means coal that the "theaters"

weather, the "North Dakota" consumed 48 per cent more coal than the "Delaware."

It has ättelys been understood that the turbine aboved its best efficiency when it was being driven at full speed, under which conditions its coal communition is as good if not better than that of the reciprocating engine. At anything less than full speed the utribine consumption becomes relatively larger and at cruising speed considerably so. But it has taken such a "best as this, made under seagoing conditions, to show just how extravagant is the coal consumption of the turbine under cruising conditions. At the same time it must be remembered that the turbines of the "North Dakota" represent that the turbines of the "North Dakota" reprea comparatively early type, and that in the later designs the coal consumption at moderate speeds has been reduced.

What makes the record of the "Delaware" so very significant is the fact that she recently carried out her annual full-speed trials, at the close of some 19,000 miles of all but continuous steaming, and under conditions which show her reciprocating en-gines to be remarkably reliable, and capable without any preliminary preparation, of equaling and even surpassing the results obtained during the action of the control of the control of the control of actions are control of the control of the control of the the following facts which are taken from the log of the ship:

Early in the present year the "Delaware" steamed at 12 knots from Cherbourg for Guantanamo, Cuba, where she received wireless orders tanamo, Cuba, where she Pécètred seizeless orders to proceed at once at 15 knots to Hampton Roadis, a further distance of 1,100 miles. She reached Hampton Roads with 500 tons of coal in her bunkers. Here, after thirteen days in port, she received instructions to take the body of the Chilliam Minister to Valparaiso, which she did; and after ten days at Valparaiso steamed back around the Horn to Boston. At 5 A. M. of April 80th, when nearing Rattm Harborn, a wireless morter was received from Boston. At 5 A. M. of April 26th, when nearing Boston Harbor, a wireless order was received from the Navy Department, to hold the ammal "surprise" steam trials of the vessel at once. She reached Boston at 10:30 April 26th, took on a thousand tons of coal and fresh provisions, and 26th at 9 A. M., April 27th, for the trial course.

April 27th, for the trial course.

April 27th, for the trial course.

This was surprise trial with a vengeance; for the ship had just concluded some 19,000 miles of steaming without undergoing any dock repair or machinery over-having whatsoever. Nevertheless, the "Delaware," steaming for four conscoutive fours, at full power, made an average of 31.86 knots, which is nearly a third of a knot more than the 31.56 knots she made on her official trials. But she did even better than that; for on the twenty-four hour continuous run at full power, she averaged 31.32 knots, and this in spite of the fact that she was burning coal only, had her regular watch in the fire rooms and was cleaning firer as usual. A further tribute to her engine room efficiency is found in the fact that the ship has steamed 50,000 miles without any adjustment of her engines.

without any adjustment of her engines.

If there is any better record of motive jower efficiency on a modern deadneaght than the, it would give us great pleasure to record it.

The Interstate Commerce Law

Its Development and Administration

By Judge Judson C. Clements, Chairman of the Interstate Commerce Commission

THE whole structure of interstate commerce regulation, including the federal safety appliance and
employees' personal injury laws, is based upon authority wested in Congress by the commerce clause of the
constitution. Although the adoption of this provision
antestased by some forty years the first mile of railway,
its application to other features of commerce pales
into insignificance when compared with its practical
polication to present-day transportation on our nearly
two hundred and forty thousand miles of railway.
This is one of many illustrations of the great wisdom
and keen foresight of the philosophers and patroits
who framed the constitution. They did not deal merely
with inaufble matters in their immediate sight, but
constructed upon ever-stisting, fundamental principles
applicable to whate'ere changed conditions might arise
in the course of human progress. It has been said
truly, "Times change and men change with thom, but
principles never." With the progress of thus circumstances and conditions change, requiring new and suit
shade rules of clause have the adventures of when the relief of them by the adventures of when the relief of them by the adventuring a few and suit
shade rules of clause have the adventures of them.

shallow and considerating have an able rules of action, but the principles of justice governing natural rights are immutable. For the first fifty years or more of railway transportation, conditions did not strongly demand the exercise of this federal authority; but with the constantly increasing incorporation of separate roads into great systems of through and continuous lines, the combinations of these systems through associations, the suppression or diminution of compatition by pooling and otherwise, and the kendency to favor those offering large and frequent shipments or the disadvantage of shippers of less commercial importance, there came general public necessity and demand for relief against the baneful effects of unjust rates and discriminations. This all culminated in the pussage of the Culiom-Reagan bill, approved February tith. Sift, known as the interastic Commerce Act There had been no definite legal requirement, nor even manifestation of a public policy and the carriers, sithough they had been and were angard in a public service affected with a public interest, were under obligation to serve the public on terms of reasonableness and equality it is not surprising, therefore, that in the contest for business, conducted mainly with a view to oriporate gain, there resulted deportable con-

Act of 1887 in the very nature of the case was swammental and tentative because Congress was then just beginning to biase the way instantiated by the case of the

to "keep itself informed as to the manner and methon in which the same is conducted;" also to report in Congress "such information and data collected by the commission as may be considered of value in the determination of questions connected with the regulation of commerce, together with such recommendations as to additional leg. ation relating thereto as the commission may down necessary.

The fundamentals of this act are that rates, regula tions and practices affecting interstate transportation shall be reasonable and just and devoid of undue and unreasonable discriminations; and after the declar ation of these principles practically all of the subs quent provisions of the law constitute machinery to give effect to these substantive requirements. It has een said by high authority that the embodiment of these requirements in the act was simply putting into statutory form principles of the common law. or not this be true as to discriminations it certainly is with regard to reasonableness in the amount of rates. Yet up to and for a time after the passage of this act in 1887, it is doubtful if there can be found in any of the courts a record of judgment for damages on account of an unreasonable rate. In practical effect, therefore, this theoretical common-law right of recovery was a dead-letter. The reasons are manifest; there was no requirement for the establishment rates as a standard to be observed alike as to all shippers: neither was there a satisfactory basis of supports; nature was there a satisfactory operation or other measurement for the determina-tion of the reasonableness of rates. As a practical matter a shipper could not hope to maintain such a

A Comme

contest under the conditions that were then existing. The passage of this act was strenuously resisted on many grounds, constitutional and otherwise. It was alleged to be radical, revolutionary, un-American and an unjustifiable interference with the freedom of contract and with aucient commercial usages. It was contended that that government is best that governs least. But the brutal doctrine of the survival of the so-called fittest did not prevail; neither on the other hand did the passage of the act mark a recognition of principles that were radical or revolutionary, but it did give additional evidence of the masterful capacity of the English-speaking people in the interest of long recognized principles of justice to initiate new and necessary remedies and forms of procedure to meet a change in conditions. This legislation, with its new forms of procedure, was as necessary to meet modern conditions and to remedy a deplorable failure of justice as was the institution in England hundreds of years ago of courts of equity and equity proceedings



Judrouge Munest

to remedy the failure of justice under the common law, which proved inadequate in many cases by reason of its universality

It would be just as reasonable to allow one party to n ordinary legal controversy to determine for himself the rights of both as to permit carriers under modern conditions to finally determine what their patrons shall pay for a transportation service Experience does not ustify the contention formerly made that the interests of the carriers may be relied upon to protect the rights and interests of each of their patrons. There is equal necessity for the determination of controversies of each of these classes by an impartial public tribunal No specific formula for the exact measurement and ascertainment of the reasonableness of a given rate for a particular service has ever yet been devised. This can only be approximately ascertained by the ientious application of an impartial judgment to the facts, circumstances and conditions affecting the service in each individual case. It is therefore of the utmost importance not alone for the protection of car-rier and shipper, but the consumer as well, that the tribunal applying its judgment in the determination of these matters should be just and keep constantly in of these matters should be just and keep constantly in mind the necessity for sufficient earnings to provide for efficient service to the public as well as that the public should be protected from excessive rates and unjust discriminations

While the act as first passed denounced rebutes and unjust discriminations, it provided penatics only against carriers for granting rebates; there was no penalty for shippers seeking or accepting unlawful.

concessions. But within a little more than two years, upon the recommendation of the commission and upon sound principle, Congress provided penalties against shippers as well Soon thereafter a large shipper and receiver of rebates who was called upon to testify before the commission as to these discriminations refused to do so on the ground of self-incrimination, thus invoking his constitutional protection, notwith standing that the act provided that while a witness should not be excused under such circumstances from testifying, his testimony should not be used against him in any criminal prosecution. The plea was sustained by the United States Supreme Court, which pointed out, however, that the enactment of a provision protecting a witness altogether from prosecu-tion on account of any matter about which he should be required to testify would not justify his refusal This resulted in the passage of another act in 1893 in conformity with the suggestion of the Supreme Court Subsequently the constitutionality of this act was sus tained by the Supreme Court

In the meantime another constitutional question arose involving the validity of a provision authorizing the commission to institute and conduct general inquiries into the conduct of railroads. This provision was sustained by the Supreme Court in a deciano of five to three

Thus for a number of year the authority of the commission to ascertain the facts absolutely necessary to a just determination of questions was impaired and held more or less in abeyance

In 1897 came the decision of the Supreme Court to the effect that the law did not empower the commission to prescribe a future rate however unreasonable it might find the exlating rate to be

In 1903, following the exposure in a general investigation by the commission of wholesale relating on important shipments, particularly in the Northwest the commission attempted through the courts to enjoin carters engaged in such practices, and while this question was pending in the Supreme Court, the Elkins billion was passed, specially authoriting such imputations and preserving larger penalties for discriminations and departures from the published rates. This latest enactment considerably strengthened the law as to discriminations because under the original act it had been held by the courts that a conporation was not indictable and that proof of a departure from published rates established no offense, as that fact of itself did not prove discrimination—that for another theory of the control of the co

In 1906, the commission, pursuant to a joint resolution of the Congress, instituted the well-remembered investigations into the relations of carriers to the coal and oil business and producers of those commodities, disclosing most flagrant and extensive discriminations induced to a large extent by the bribery of rallway offidevices While the investigations were in progress the so-called Hepburn act was passed, increasing in many respects the power to regulate interstate commerce and conferring upon the commission authority upon complaint and full hearing to prescribe for the future just and reasonable rates, regulations and practices in lieu of those found to be unjust and unreasonable, also conferring jurisdiction over express panies, pipe lines and sleeping car companies and defining transportation so as to include refrigeration, ventilation, elevation and other services theretofore not regarded as part of transportation. This act contains the so-called commodities clause, providing that

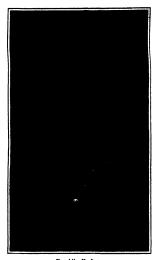
"From and after May first, nineteen hundred and eight, it shall be unlawful for any railroad company to transport from any State, Territory or the District of Columbia, to any other State Territory, or the District of Columbia, to the state Territory, or the District of Columbia, or to any foreign country, any article or commodity, other than timber and the manufactured products thereof, manufactured, mined, or produced by it, or under its authority, or in which it may have any interest, direct or indirect, except such articles or commodities as may be necessary and intended for its use in the conduct of its business as a common carrier."

It also requires the carriers to keep open to inspec-

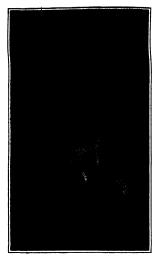


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Franklin K. Lane,



Edgar E. Clark.

tion of the commission their books and accounts in such a form as may be prescribed by it and specifies penalties for the falsification, multiation or destruction of records. The exercise of the commission's authority under this provision has resulted in uniform standards and has afforded a powerful check against unlawful practices, as well as produced a much higher degree of reliability in reports of carriers.

The latest amendment, known as the Mann bill, was enacted in June, 1910, and empowers the commission to suspend the operation of tartifs providing for increased rates, subject to investigation as to their reasonableness and propriety. The enactment of this provision is a distinct recognition of the off-demonstrated necessity for the prevention of transportation attraction of the provision is a distinct recognition of the off-demonstrated necessity for the prevention of transportation those upon whom injury would fall if the wrongful those upon whom injury would fall if the wrongful date of the premitted. In the premitted in the register of the prevention in damagnetic freed is for objurious reasons immossible.

The amended act confers upon the commission jurisdiction and authority over telegraph and telephone lines, and also empowers the commission to institute investigations upon its own motion, with authority to make suitable orders therein the same as if formal complaint had been made by a abipper. It also enlarges the powers of the commission with reference to the certainly the control of the con

the establishment of through routes and joint rates.

Merely to illustrate the growth of the work of the
commission under the invigorated law, the following
increases are significant.

There were filed with the commission from 1887 to 1306, 378 complaints, resulting in 339 reports or opinions, printed in eleven volumes of reports. Since the Hepburn act was passed 4,135 complaints have been filed, and 2,000 decisions, including unreported and memorandum opinions, have been rendered, filling nine volumes of printed reports. Many investigations have been undertaken both pursuant to resolutions of Congress, and on the commission's own initiative The

records of the investigations in two of the latest proceedings, in the matter of rate advances under the act of 1910, printed under a Senate resolution, fills ten octavo volumes. Two hundred and thirty-nine criminal prosecutions have been instituted for violations of the act, and about three-querters of a miltion dollars in fines have been collected from guilty shippers and carriers. Repeating over two million dollars has been ordered in formal contested cases and over one million dollars has been allowed upon the application of carriers on stipulated facts and suitable laugury.

In the performance of its duty to prescribe the forms of tariff schedules and generally to enforce the provisions of the act, the commission has been under the constant necessity of interpreting not only the tariff achedules and specific items thereof but various provisions of the law itself in their application from day to day to specific shipments, as multitudinous (Continued on page 607).



Charles C. McChord.



James S. Harlan



Balthasar H. Meyer,

Relations of the Railroads to the Public-Co-operative, Not Antagonistic

By W. C. Brown, President New York Central & Hudson River Railroad Company

IF there is compensation in all things there must be compensation even to the railroads in the running fire they have been under during this last generation and especially during the last six or seven years. It may be that the attention which has been given to their affairs will lead to their being so well understood both by railroad men and the people as whole that discussion will come to rest upon mutu-

ally understood and agreed premises. That alone will be a considerable gain. Disputants never get anywhere unless they stand upon common ground In all things the only common ground is fact, and in matters of nation-wide importance it is all the more necessary that discussion and action be based upon exact fact. The people need facts, the railroad men need facts, and the railroad men need to present facts to the people. this generation of rapid railroad extension and tremendous increase in traffic, problems have arisen which the railroads have naturally looked at from one side and the people from the other They have not always been thoroughly understood either by the railroads or the people. What both sides have needed is more light. When every-body has the facts there will be no chance for misstatement on either

It is the simple truth that the railroads cannot succeed unless they serve the industry and comce of this country torily in the present, and make proper provision for satisfactory service in the future. It is likewise the simple truth that the people of this country will not prosper unless they are willing to pay a fair rate for such services

The first duty of a railroad is to carry passengers and property safely. The standard code of rules developed by the American Railway Association makes impossible wreck or collision from any cause immediately connected with the moving of trains as long as those rules are observed. That these are not always observed is the fault of no one but the employee who is derelict. In all the laws that have been passed to compel the railroads to adopt this and that appliance, to shorten the hours of labor, or otherwise to favor the railway employee does anyone know of a single legislative enactment in this country which makes it criminal for a railway employee to carelessly disregard an order thereby jeopardizing the safety of lives or of property? As has recently been pointed out by Mr. Acworth, the discipline of railway employees is more difficult in this than in other countries be-

cause here one of these men when discharged can casily obtain another position, while in England, for example, it is an achievement to enter the railway service and a disaster to be discharged. to be a diminution in ratiway accidents should not public opinion co-operate with the ratiway managers in enforcing discipline and obedience to rules?

To the safe and prompt carriage of freight is not only necessary the proper discipline of employees in its handling and loading, but careful packing and marking on the part of the consignor. If our shipald always pay due attention to this they would not have so many damaged shipments and the loss and damage payments by the railways would be much less.

Every accident that results in loss of life or po sonal injury to passenger or employee not only en-table expense which it is to the interest of a railro: tails expense which it is to the interest of a railro: company to avoid, but impairs its prestige. Every

wreck or other accident that results in damage to property entrusted to its care is a source of greater and greater annoyance to the railroad company than to the shipper. It is likewise with delays in the passenger service or a freight blockade. In all of these respects the interests of the railroads are in no wise antagonistic to those of the public. In his daily work the railway officer can never lose

President of the New York Central and Hudson River Railroad.

sight of the fact that co-operation with the public in the interest of the community at large is essential to the success of his company. To study, establish and maintain such co-operation is a large measure of his most serious work. In the broad sense that all the service rendered by a railroad company is public service, proper co-operation with the public is the erious thread that runs throughout all of his work Some lines of activity may prosper in the face of general adversity. Their very opportunities may be found in adversity. The railroads, however, can prosper only when the community as a whole prosp for business depression means the falling off of traffic His duty to develop traffic moreover forbids the rallway officer to meet antagonism with antagonism. Although communities as a whole, chambers of com-merce and shippers' associations may vent bitterness upon his company, condemn his actions and impugu his motives, the railway manager is obliged to do

the best he can in the way of conciliation and co-operation Time was when the railway managers of this country were supposed to be continually on the aggressive in their dealings with the public. What ever may have been the status during a past era they certainly have been on the defensive during these many years, and during these years have labored as

never before to meet the destites of the public The tailway manager has become the patient servant of the people and has sometimes had cause to think that his master is fault finding overbearing and unreasonable is struggling in the hope of a better day

Not only is the prosperity of the rathroad dependent upon the wel-fare of the community, but the welfare of every community is pendent upon the prosperity of the railroad It cannot serve the community unless it is alloved that return which will enable it to pay wages buy supplies maintain its plant and equipment, and make im provements and extensions necessary for its future. This means that there must be due return to capital and prospect of return to the capital needed for the require ments of the future

Every responsible citizen has not only an interest in the satisfactory operation of the railways that are now in existence, but he has an interest in the extension of rall-ways throughout the regions that are not at this time adequately supplied Notwithstanding the railway building of the past, there remain in the United States thou sands and thousands of square miles of land that could be made productive if provided with adequate transportation facilities for its development. The land area of the United States prises very nearly three million square miles. The region whose railways are designated by the Interstate Commerce Commission as Group No 2 embraces practi-cally all of New York, Pennsylvania and Maryland, all of New Jersey and Delaware and a small portion of West Virginia, comprising 108,873 square miles, or only 35 per cent of the entire country. The census of 1910 shows that this area contains nearly 20,000,000 a trifle less than 22 per cent of the 92,000,000 of our population Yet, here in 1909 were 49,277 miles of tailroad track, or 144 per cent of the total of 342,351 miles of track in the United States

In extreme contrast with this is Group No. 10, composed of Wash-ington, Oregon, Idaho, California, Nevada, Utah, Arizona, and a part of New Mexico This group con-This group tains 759,409 square miles of land

surface, or 25.6 per cent of the total area of the United States, but it had in 1909 only 27.053 miles, or but 79 per cent of all railroad track. In Group were 452 square miles of land for ever mile of railroad operated, while in Group No. 10 there were 35.84 square miles.

These Western States can doubtless sustain sity of population equal to that of the North Atlantic seacoast, but that population cannot exist without railroads. Indeed, no such population can be attained unless the railroads extend as the population grows The farmers and merchants and manufacturers and

every other class of the citizens of this country are intimately concerned with the extension of the railroads. Land increases in value as its products can be transported to markets, and when to an increasing number of homes are brought the conveniences that make life worth diving. Manufacturers will (Continued on page 697.)

Transcontinental Railroads in the United States

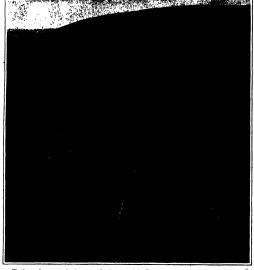
The Seven Great Systems Which Radiate from Chicago to the Pacific Coast By William F. Hooper, Associate Editor, Railway Age Gazette

F by the term "transcontinen-

I by the term "transcontinen-tal radioad" one means a line from the Atlantic coast to the Pacific, then there is no trans-continental radioad in the United States, the only one in America in operation being the Canadian Pacific mentioned elsewhere Transcontinental, however, as applied to sallroads, is generally understood to mean a road running from an eastern terminus, somewhere on the north and south line drawn from Chicago to New Orleans, to the Pacific Decame the traffic of the United States both passenger and freight, has been built up in the way it has, there is very little, if any advantage to be gained by the operation of a railroad from the Atlantic coast to the Pacific.

A practical traffic man will tell you that there is no advantage for a transcontinental road (meaning a road running from the Pacitic coast to Chicago or St Louis) to have an eastern connec tion of its own, in fact, he would probably tell you that such a connection would be a disadvantage, free bargaining on the part of the western road as between the different trunk lines in eastern territory The accompanying map shows representative transcentinental reads, but no castern connections are shown, because the map would not permit showing all of them, and it would be misleading to show only part of them

The transcontinental roads in the United States all have certain



The horseshoe curve in the natural coliseum of the Deschutes River. On opposite banks 'are seen the two lines now being built by the Harriman and Hill sys

COMPETITION IN A CANYON

characteristics in common. They all have to climb over the continental divide; they all have to cross long stretches of country which furnish little, if any, local traffic, and they all have to com pete on through freight from the Atlantic seaboard to the Pacific coast with water-borne freight going from the eastern United s through the Straits of Ma gellan to the Pacific coast, or with freight that moves by water down the eastern coast of the United States to the narrow part of Mexico and crosses this strip of land by the Tehuantepec National Railway, and then moves again by water up the west coast. the Panama canal is finished they will have to compete with a much shorter all-water route.

The first of the transcontinen-tal railroads across the western deserts were built rather more for military and governmental ressons than through any hope of their immediately earning a sufficient amount to make the enormous investment in their construction profitable. Since private owners of capital were not inclined to be philanthropic, the government had to hold out in ducements to them to invest their money by giving them land grants and making them loans Of the seven roads shown on the map, five were extended to the Pacific coast by government help and the other two without. The writer has taken the Chicago, Milwaukee & St. Paul, with its subsidiary, the Chicago, Milwaukee & Puget



THIS MAP SHOWS THE MAIN LINES OF THE ELEVEN TRANSCONTINENTAL RAILROADS OF THE UNITED STATES AND CANADA

Scand; the Northern Pacific; the Great Northern; the Union Pa-cific; the Denver & Rio Grande, with its subsidiary, the Western Pacific; the Atchison, Topeka & Santa Fé, and the Southern Pacific, as the more important transcontinentals. Of these the Denver & Rio Grande and the St. Paul were extended to the coast without government aid In the ac-companying table, in which certain rather interesting character-istics of each road are shown, the Denver & Rio Grande is omitted because it is impossible to give any figures for the newly constructed Western Pacific, and it would be quite misleading to give the Denver & Rio Grande's figures by themselves The Denver & Rio Grande itself only runs from Denver, Col, and Pueblo, on th east, to Ogden, Utah, and Salt Lake City, on the west, with a great number of branches through Colorado. From Salt Lake City west the Goulds, using the Denver & Rio Grande credit, built a line paralleling in many places line paralleling in many places the Southern Pacific from Sali Lake City to San Francisco It was built without any govern-ment aid, and built with modern standards and with modern standard grades; so that its actual initial cost was far higher than that of the other transcontinental roads The other roads, with the exception of the St Paul's Pacific coast extension were built as cheaply as possible at first, and slowly, as the years have gone on and the freight have gone on and the freight traffic and passenger business has increased, the properties have been improved, rebuilt and often relocated, so that to all intents and purposes they are entirely different lines than those orig-

inally built

Even with its Western Pacific, the Denver & Rio Grande would not be a transcontinental road if it were not for the fact that it is controlled by the Missouri Pa-

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This type of bridge rendered possible the rapid construction of pioneer railroads in the western country where steel was costly and timber plentiful and cheap.

HOWE TRUSS TIMBER BRIDGE ON THE PORTLAND & TILLAMOOK RAILWAY, OREGON

Two competing railroads being built through the desolate Deschutes River Canon. On the right is Harriman's Deschutes Railroad; on the left Hill's Oregon Trunk Line.

THE FIGHT FOR RAILROAD TERRITORY

cific as well as by the Goulds; and the Missouri Pacific, which is also controlled by the Goulds, runs from Denver and Pueblo east to Kansas City and Si Louis

The Chirago, Milwankee & St. Paul's Pacific coast extension is the other transcentinental that was built without government and The Chirago, Milwankee & St. Paul Railway proper runs from Chirago and St. Paul to the Missouri River at Mobridge, S. D., with a mass of hanch lines through Milwankee & St. Paul Railway, Milwankee, Chirago and South Dakota, and with a line extending as fin a Rapad City. S. D., which takes it into the Ruck Hills. From Mohitdge west through the southwestern course of North Inskota, through the length of Montana and through the breadth of Washington, the St. Paul built a line to Tavonia and Scattle on Piggel

The Chicago, Milsankee & Brail Scoreally understood to be controlled by the Rockefeller and Standard Oll Interests, the Missour! Pacific, Denver & Roc Grande and Western Pacific, as a renarrolled by the Goulds, the Great Northern and the Northen Pacific are both what are known as Hull Inter, controlled largely by James J. Hill, the Pacific and the Southern Pacific are the Southern Pacific are the Southern Pacific are the Southern Pacific are the Southern Pacific and The Southern Pacific and

The compellition between these seven roads, both for for ight and passenger business, is very keen, and aithough it might seem surprising at first, the compellion is nearly as keen between the Union Pacific and the Southern Pacific, for instance, which are controlled by the same financial Interests, as it is between the

Continued on some 588.)



A track-laying machine which places ties and rails on the readbed, advancing at the rate of four miles a day. The material is brought forward continuously from the leaded train in the rear and deposited in place.

The Growth of American Locomotives and Railroads.

From the Baby 5-Ton Engine of 1832 to the 188-Ton Giant of To-day

By Herbert T. Walker

E IGHTY years ago there were 95 miles of railroads in operation in the United States. To-day there never 242,478 miles, a length that if extended in a single line would encircle the earth more than nine times.

This enormous growth of our railroads has naturally been accompanied by the expansion or increase of size of the American locomotive, but with this difference, that while there is practically no limit to the extension of a line of railway, there is a well-defined limitation to the size of the engines, which must be kept within the measurements of the track and the height and within of bridges and other permanent structures. These rigid dimensions are known as the loading gage, and are substantially the same to-day as they problem of designing origines to haul the constantly increasing weight of trains is one of exceeding difficulty, and its solution may be regarded as one of the practice of th

In the year 1831, Matthew Baldwin, founder of the famous Baldwin Locomotive Works, received an order for a locomotive from the Philadelphia, Germantown & Nortlatown Railroad Company, whose short line of six niles was operated by horse-power In design.

ing the engine Baldwin was guided by the plans of the "Planet" engine designed by George and Robert Ste-phenson for the Liverpool & Man-chester Railway in 1830. When com pleted the engine was chistened "Old Ironsides," and was tried on the road November 23rd, 1832. This engine is shown in the first figure of the accompanying illustration, which presents six American passenger locomotives drawn to a uniform scale for the pur-pose of comparison "Old Ironsides" weighed something over 5 tons. The driving wheels were 4 feet 6 inches in diameter The cylinders were 91/4 inches diameter by 18 inches stroke Its tractive effort was about 1,200 pounds. It attained a speed of 30 miles an hour with its usual train, but it only ran under favorable conditions, for in rainy weather the cars were drawn by horses.

During the next seven years great improvements were made in American locomotives, and the leading truck had come into use. A representative engine, built at the Rogers Locomotive Works, is shown in the second figure of our

En.

gines of this class ran on the Jersey city & New Brunswick Rallroad in 1839 The cylinders were 11 inches in dia meter by 18 inches stoke Driving wheels 4 feet 6 inches in diameter Weight about 10 tons. Tractive effort shour 2,000

illustration

pounds. The orlinders were inside the frame, and the valve gar, having the hook motion, was on the quisar. The time during which this easine was in service was as interesting period of railroad history. Business was increasing faster than the means for handling it. Our railroads were like a boy of the awieward ling it. Our railroads were like a boy of the awieward see who is constantly outgrowing his clothes. They were getting unmanageable. Röugh-and-ready methods of handling trains—well enough for the pioneer days—were causing bad wrecks that alarmed even the free and easy American public. The writer has interviewed old railroad men (come of them scarred and mained by fearful accidents) whose memories go back to the fortice, and a recital of their apprehence would be truly surprising. A slight sketch of the early railroad days may be given here, for an everything goes by comparison, the best way to judge of the present is to measure it with the past, and we

How many of us who traval in the luxuriously appointed trains of to-day, with an almost perfect service, know or stop to think of the hardships and dangers endured, not only by the railroad men but by the traveling public, who often paid higher rates of fare than they do to-day, and for

can thus appreciate the progress made up to recent

fare than they do today, and for accommodation and service so greatly inferior, that a detailed description might well be doubted as true.

The engines had this boiler plates, with lay joints and ringic rivets. There were no pressure gages, and the only way to estimate the boiler pressure was to raise the lever of the safety valve by hand and judge by the seens of reeling, so that, in the words of an old engine man, "If the lever was easy to raise we had 100 pounds; if it was not so easy, we might have 75 pounds. If it was hard to raise we didn't know how much we had, not did we know had, not did we know had, not constitute the house of the house had had not h

Freight trains were cometimes forty-eight hours late on a run of less than 100 miles, and the train had to be side-tracked to enable the crew to get some sleep in the engine cab. What would our shippers have to say about this kind of service, when freight trains to-day travel 40 miles

an hour to deliver their goods?

Turning to the passenger service, what would the modern traveler think of riding on arailway not protected by either telegraphs or signals? In the absence of telegraphs the superintendent was in protound agnorance of the position of the



This engraving, drawn to a uniform scale, shows the growth of the American passenger locometive from the "Old ironaldes," 5 tens in weight, of 1985 to the powerful Atchison & Santa Fe locometive of 1916, weighing 198 tens.

In case of accident or delay, trains were me me in account to their whereabouts. Some-men want on horsebuck to look for the missing ut usually the superintendent sent a man out e. This proceeding was attended with dansee at eagles. This proceeding was attended with da-ger, as there was a chance of meeting the belated trimin head-on at some sharp ourse. We may thus compare the conditions with those of our own day, the train dispatcher knows the position of every train on his division, and, in some cases, can even communicate with the conductor of the train by

Lestly, we will take a look at the way our predecomors traveled on American railroads, by going back to the forties and imagining ourselves boarding the pe pessenger train on, we will say, a winter's

On entering the car, the first thing we see is the stoye. It is of hideous design and is placed in the middle of the car. It burns wood, and for want of proper attention, sometimes gets red hot, to the insufterable annoyance of passengers unfortunately seated near it. The seats are narrow and otherwise uncomfortable. There is no law against apitting, and the nithy condition of the floor justifies the criticism found in Dickense "American Notes" and "Martin Chauslewit." When the hour of departure has ble annoyance of passengers unfortunately seated

we inquire the cause of delay and are santly informed that the conductor and engi-neer are "bracing up" in the lunch room. At last a start is made, and when under way we find that we are going about fiftee miles an hour. Certainly not twenty. The track is not ballasted. The rails

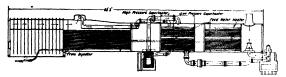
illustration. It was built at the Rogers Locomotive Works in 1851 for the Delaware, Lackawanna & Western Railroad. It was named "Wyoming" and was the first passenger engine for that line. The track gage was 6 feet. The cylinders were 16 inches diameter by 20 inches stroke. Diameter of driving wheels, 5 feet 8 inches. Weight, 28 tons. Tractive effort, about 7,500 pounds. This engine had the Stephenson link motion and was beautifully finished, the dome and safety valve casings, boiler bands, and wheel guards being lagged with polished brass, which gave the engine a handsome appearance. To-day, our engines are far less pleasing to the eye.

The next twenty years saw great changes in our railroads. The volume of business was increasing by leaps and bounds and the public were demanding faster trains. Here was, and is, the greatest source of anxiety to our motive power superintendents. The demand for higher speeds is always accompanied by a requisition for heavier trains, for high speeds cost money and it does not pay to run light fast trains. The locomotive engineer of forty years ago was ready to design powerful engines, but he was confronted by the difficulty of light rails. If he responded to the requirements of the transportation department he got into trouble with the maintenance of way de-

engines. In the year 1902 a still heavier pa engine was introduced having a pair of trailing wheels behind the drivers. A side elevation of this engine is shown in the fifth figure of our illustration and its length of 48½ feet, when compared with the previous engine, is strikingly apparent. This engine was built for the Chesapeake & Ohio Railroad by the American for the Chesapeake 2 Onlo Railroad by the American Locomotive Company at theis Schenectady works. The cylinders are 22 inches diameter by 28 inches stroke. Driving wheels, 6 feet in diameter Pressure, 200 pounds. Total heating surface, 3,5328 square feet Tractive effort, 32,000 pounds Weight, 95 tons

During recent years the weight of passenger has so greatly increased as to necessitate a radical departure in locomotive design. In 1856 a passenger coach weighed about 25 tons. In 1872.5 the weight had crept up to 28 or 30 tons. To-day a par-lor car weighs about 60 tons, and our passenger trains frequently weigh 400 tons behind the tender As the leading gage limit was reached years ago, the only way in which the dimensions of a locomotive can be expanded is in the direction of its length. This was first done about the year 1888 by M Anatole Mallet, a French engineer who introduced his "articulated" locomotive, but the latest development

of this class of engine for passenger service is shown in the last figure of the illustration This engine was built in 1910 by the Baldwin Locomotive Works for the Atchison, Topeka & Santa Fé Railway. The length of this mammoth locomotive is 69 feet 6 inches The boiler with its superheater and feed-water heater is connected rigidly to the frame



Sectional view of boiler, superheaters and feed-water heater as applied to "Santa Fe" Mallet locomotive.



as a sticing locamotive by adding the superheater and ford-water heater sections. The entire weight 200 too, the tarder 117 too.

The H.F. Cylinders are 28 inches dist, the L.F. are 28 inches dist, the common stroke is 28 inches. The mass, dwwhere all is 11.0 to 1.0 t ngth over all is 120 feet ! hazled 1,911 tons at 12 : usual manner, it would :

SANTA FE MALLET FREIGHT LOCOMOTIVE, THE LARGEST IN EXISTENCE

are either of strap iron, or if of the standard pat-tern, they are without fish plates, and the car turches and bumps in a way that would be into-erable to the modern passenger. Anon, comes the conductor, swinging his lantern and collecting fares, as many or as few of which he will turn in to the company, as he pleases. In common with the brake men, he wears no uniform. He is brusque, if not half way inscient to male passengers, but extremely polite to women. Some of these conductors hire negro lads to carry their lanterns. It is whispered that a few of them are richer than the president of the railroad. Illumination is by miserable oil lamps and reading is sizumination is by miserable oil samps and reading is out of the question. We may beguile the tedium of the igniner by looking out of window and watching the continuous shower of bright sparks dritting over the fark landscape. The Jooemotive burns wood and throws much fire. Dickens called this appearance

But we are not corry when the prolonged sound of e engine whistle gives the signal for "down brakes" and the breheman hurries out to attend to his duties. The trials spinne to a gradual and sensetaward attended to the state of the state s brakeman hurries out to attend to his duties.

About the Control

partment, for his engines would batter out the track Some of the rails of seventy years ago were only 33 pounds to the yard and the heaviest was but 54 pounds. As late as the year 1851 rails in the eastern part of the United States weighed 56 pounds to the yard, laid on hemlock ties. No fish plates, but a castiron chair at each joint with an extra-heavy tie be-neath it. In 1857 rails of 73 pounds were in use, but they were considered heavy.

In 1887 and subsequently, rails weighed from 75 to 80 pounds per yard. To day rails of 100 pounds per yard are in general use.

As regards speeds, we find that in 1849 the ave need of passenger trains was 23 miles per hour 1864 the average speed of express trains was 32 miles per hour on a few of the most important lines. In 1889, 40 miles an hour was the average ex-press speed. To-day speeds range from 50 to 60, but spurts of 80 and even 90 miles an hour are occasionally made

heavy trains of 1872 will be found in the fourth figure of our illustration. This was No. 573, built for the Pennsylvania Railroad at the Altoona shops. This remaryvanus articular and its chief dimen-aions were: Cylinders, 17 inches diameter by 24 inches stroke; diameter of driving wheels, 5 feet 2 fnches; weight, about 37 tons; total heating surface. 1,056.98 square feet; boiler pressure, 125 pounds; tractive effort, about 1,100 pounds. This style of engine was the standard locomotive for many years.

About twenty-nine years ago six-wheels-coupled en-

gines for heavy passenger service ogne into the field and some of the highest speeds were attained by these

in which are carried a pair of trailing wheels, the six-coupled drivers and the high-pressure cylinders. The low-pressure cylinders, four-coupled drivers, and leading truck are carried in the separate frame, to provide for lateral movement as the locomotive enters a curve A full description of this engine appeared in the SCIENTIFIC AMERICAN of January 29th, 1910, but the leading dimensions may be repeated here. Diameter of high-pressure cylinders, 24 inches by 28 inches stroke; diameter of low-pressure cylinders, 38 inches by 28 inches stroke, driving wheels, 6 feet 1 inch diameter, heating surface, 4,756 square feet, superheating and re-heating surface, 1,121 square feet; steam pressure, 200 pounds, weight of engine, 188 tons, tractive effort, 58,000 pounds, sufficient to lift as a dead weight a passenger engine of thirty-five years ago. This engine is equal to the power of two ordinary locomotives, and hauls trains over the heaviest mountain division of the line

In conclusion the writer takes pleasure in thanking the Baldwin Locomotive Works, the American Loco-motive Company, and Mr. C H. Caruthers of Yeadon, Pa., for the use of data embodied in the foregoing

A Moving Land, -One of the broad slopes of Mont Gringuez. France, is reported to have become detached from its foundations, and to have moved over a distance of nearly a quarter of a mile, carrying with it the soil, meadows and woods, and covering up in its passage roads and bridges that stood in the way. A chestnut grove has traveled 500 feet without suffering any apparent damage, but many small lakes have been formed by the damming of the waters.

The Transcontinental Railroads of Canada

How the Government and the Railroads are Co-operating in Building Up the Great Northwest

By J. W. Whitman

THE three transcontinental railroads of Canada are distinguished from those of the United States by the fact that they extend, or will do upon their completion, entirely across the country from the Atlantic to the Pacific, with terminal ports on each ocean. Of the three whose main lines are shown upon railroad map published on page 588, the Canadian Pacific is completed, and the Canadian Northern and Grand Trunk Pacific are under construction and both slated for completion in the year 1914

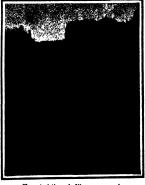
Canadian Pacific Railway.

The charter granted by the Canadian government to the Canadian Pacific Railroad, February 18th, 1881, prescribed that the road should be carried through to prescribed that the road anothe be carried through to the coast in ten years time. From the government, by way of encouragement, the company received \$25, 000,000 in cash, 25,000,000 acres of land fit for settlement, and 713 miles of railroad in which were included two of the most difficult sections. At that time the great northwestern section of Canada had been favored with little or no settlement. Transporta-tion facilities to aid in construction work were not available, and the building of the line to the coast called for pioneer engineering of the most strenuous called for ploneer engineering of the most aremounts character In spite of these difficulties, however, the road was finished in five years' time—a feat which will ever redound greatly to the managerial and engineering ability of the Canadians.

The opening of the new road was followed first by a gradual, and in later years by a phenomenally active settlement of the country, which was promoted by the joint activity of the railroad and the government The fertile wheat lands of the prairies were thrown open to settlement upon liberal terms, while in later years the certainty of remunerative crops was assured n of some of the largest irrigation works in the world.

The story of the growth of the Canadian Pacific Railroad to its present commanding position has been due to the broad view which the company has taken of its opportunities, and to the realization of the fact that its system of lines, stretching from ocean to ocean, in addition to performing its great work of opening up new country and developing industries and promoting commerce, could also be made to form the central link in a continuous system of transportation reaching from the Occident to the Orient In due course lines of steamers were placed upon both oceans, and the activities of the company on land, lake and sea have grown to an extent which can be judged from the following facts: To-day the company own and control some 16,000 miles of railway 11,500 which form the Canadian Pacific Railway proper. It employs 76,000 people, all on the pension system, among whom are distributed every month some \$3,800,000 in salaries and wages. The company owns its own sleeping, dining and parlor cars, its own telegraph system, and its own express company, and the total value of its railway and equipment is \$317,

000,000. Including its service on ocean, lakes and river, it possesses a fleet of sixty-seven steamships, sixteen in commission and four building on the Atantic, four in commission on the Pacific, twenty in the British Columbia coast service, and the balance on the Great Lakes and inland waters. Also it owns a chain of sixteen hotels, built originally to provide for the lency of the system, and now all are on a paying



Characteristic rock fill across a creek.

The story of the settlement of the country can be largely told in terms of its land operation, which forms a most interesting record. Of the original grant of 25,000,000 acres the company still has in western Canada 8,000,000, and in British Columbia 4,500,000 acres, now valued at \$180,000,000. The early sales in 1883 of the most desirable agricultural land in Manitoba were made at an average price of \$2.85 per acre. In 1910, so greatly had values appreciated under the improvements due to larger rail ties and constant settlement, that one million acres ties and constant settlement, that one million acres were sold at an average price of \$14.80 per acre. To-day, in the Bow River Valley, one of the biggest schemes of irrigation outside of India and Egypt is being carried out, involving three million acres of land. The first operation covered 400,000 acres, and required 1,580 miles of ditches and canals, and all of this section has been sold. Work is now being done on an additional 500,000 acres, to be followed by extensions to an additional 200,000 acres

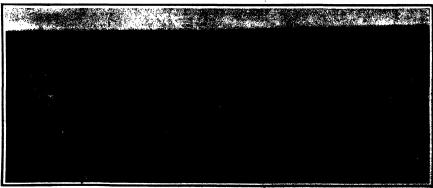
Within the limits of the present article it is impos eible to enter any further into details; but, mention should be made of the celebrated Angus shops, which are capable of turning out a complete train every day for the service of the road, which, as we have said, owns its own sleeping, dining and parlor cars So great has been the immigration into the Northwest, cularly of energetic and thriving farmers from the United States, that the company at the prese time is building betwee 500 and 700 miles of ne way each year in the endeavor to keep up with the development of the northwestern country.

The Canadian Northern Railway

It was less than fifteen years ago, in December of 1896, that the first train to earn revenue for the Lake Manitoha and Canal Railway Company—the nucleus from which has sprung the present Canadian Northern Railway system—left Gladstone, Manitoba on its one hundred mile trip to Dauphin. The gross revenue from the hundred miles operated the first year was \$60,000; thirteen men and a boy constituted the staff, and the payroll was \$550 per month. Within less than fifteen years the gross revenue of the Can-adian Northern and its allied railways has grown to over \$18,000,000, its staff has increased to 48,400, and to-day the railways of the Cauadian Northern system are running in six provinces with a mileage which has grown at the rate of a mile a day for four teen years. Farmers of the prairie provinces have over 3,500 miles of road at their service, and a glance at our railroad map on page 588 of the present issue will show that it needs only the completion of con-necting links which are being built between Lake Superior and the Ottawa Valley and between Edmonton and the Pacific Coast to make of this system a transcontinental railway, with a widely-diverging and comprehensive system of branch roads.

The expansion of the Canadian Northern in the wheat-growing belt is being carried out upon a plan which will result in the possession of five principal lines running east and west with certain northwesterly developments which will make the system as ser-viceable to the Hudson Bay bread routs to Europe as it is to the present route by way of Lake Superior and the St. Lawrence. One thousand miles from Lake Superior the company is opening up vast areas of wheat land, as fertile and more extensive than those which have assured to Manitoba and south Saskay-chewan their great reputation as wheat-producing districts. Southwest of Saskatchowsn the line is being built across the fertile Saskatchewan plain. From the first seventy-six miles of line in this district there was hauled in 1909 2,000,000 bushels of wheat to Port Arthur, and in addition to the wheat business there are vast timber tracts to the east and northwest of Prince Albert, which the new road has brought into

The expansion of the Canadian Northern from Alberta to the Pacific Coast was assisted by the guar-

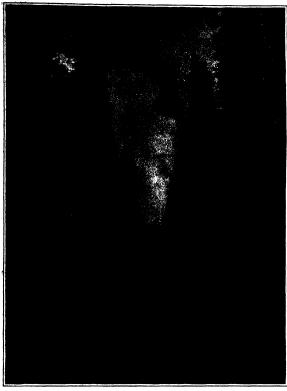


Many miles of lofty timber tresties were built to carry the grade of the Genad Trunk Fa across the depressions. These will ultimately be filled in, hashing said embanious

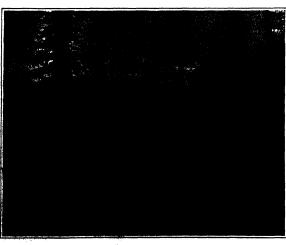
oer mile by the British Scientists government. H is a distinctive feature of this system that it has been produced from within the prairie provinces, and the earning power which it had displayed analsted greatly in securing government support, sured by an act passed in 1910, and was speedily followed by the com-mencement of construc-tion eastward from the mouth of the Frager River at New Westminster. The main line from Edmonton ivancing to meet the British Columbia section by way of Lac Ste. Anne and the McLeod River. Hence, as provided in the statute, British Columbia statute, British Columbia will receive its first competitive communica-tion with the prairie provinces during the year 1914. The main line will ascend the Fraser River canyon and will surmount the summit on its way to Edmonton by way of the Yellowhead Pass, which is claimed to be the easiest summit of any pass through the Rocky Mountains. The road will afford connection between Puget Sound and Duluth within a mileage almost the same as that of the Northern Pacific, the pioneer railway across the northwest States; but it will have the advantage that its trains have to be mit, and that of the low

mit, and that of the low elevation of 3,700 feet. During 1910 the new terminal passenger sta-tion was completed at Winnepag, for the joint occupation of the Canadian Northern, the Na-tional Transcontinental and the Grand Trunk Pacific Railway.

Contemporaneously with contemporaneously with this development in the western provinces the company is actively prosecuting the work of joining up certain separately-op-erated lines in the eastern provinces; and when this has been completed the system will have a complete transcontinental road from Quebec to the Pacific Coast. The chief of these eastern roads is the Canadian Northern Ontario Railway in con-nection with which the company is building a new line between Thronto and Ottawa, which is about completed. It is gise engaged on the construction of a line west of Toronto toward Buffalo. During toward Buffalo. During 1909 Ottawn was con-sected with Montreal and limbbe by a section of the Canadian Northern On-tarie Ballroad, which by contacting with the Cantiffve line between e St. Lawrence.



Closely massed and mutually protected from storms, the magnificent timber of the Northwest grows straight as an arrow and free from knots to heights of 250 to 350 feet.



Marion Lehrmour Glasier, B. C., a typical lake and mountain view on the line of the Canadian Pacific Railway.

THE TRANSCONTINENTAL BAILBOADS OF CANADA

between East and West mainly goes by the great lakes. By its control of a fleet of lake steamers, the Canadian Northern is, therefore, able to handle freight from tide-water to Edmonton for about eight months in the year It is necessary to supplement this by an all-rail route for which purpose the gap between Cowganda Junction and Port Arthur, roughly 450 miles, must be filled, and eventually a short line to obviate the necessity of haul-ing freight from Montreal to the West by way of Toronto This will be accomplished by connecting Ottawa with the Toronto-Sudbury line at or near Junction, so as to give rapid connection with Key Harbor. For the Cowganda-Port Arthur gap, the Ontario govern-ment has proferred a land grant of 4,000 acres per mile, and it is anticipated that the completion of this line will synchronize with the completion of the line through British Columbia, which is guaranteed for

The year 1910 is not-The year 1910 is not-able not only for the ad-vent of the Canadian Northern at the Pacific Coast, but for its appearance among Atlantic pas-senger fleets. In May the Royal Line of the Canadian Northern system began a fortnightly service between Bristol and Montreal, with the "Royal Edward" and "Royal George," ward" and "Royal George,"
the two fastest as well
as the most splendidly
equipped steamers in the
Canadian trade, which
gave Bristol its first up-todate passenger service with Canada.

The Grand Trunk Pacific Railway.

The third and latest of the Canadian Transcon-tinental railways, the Grand Trunk Pacific, has the unique distinction of being the only road ever planned and built as a definite transcontine**ntal** line, reaching from the Atlantic to the Pacific. Also it is the greatest length of railroad that has ever been conceived and put under construction in one complete scheme, since it is 3,556 miles from terminus to terminus. It is the first line to be thrown across the North American continent from ocean to ocean under one management, thereby being a transcontinental railway in the fullest sense of the word; it crosses the mountains at a lower maximum altitude than any competing line; it has been built at a more northerly latitude than was conceived possible a quarter of a century ago, the route laying fo greater part of its length between the 48th and 54th narallels and it has easier grades and curves than any line on the continent.
(Continued on page 808.)

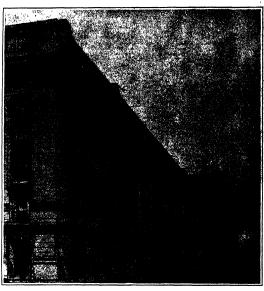
The World's Greatest Railway Terminal

How the New Grand Central Station Will Handle, if Need be, Two Hundred Trains an Hour

By Walter Bernard

A DOZEN years ago the prob-lem of handling the ever-in-creasing multitude which flowed into and out of the terminal sta tions of our leading railroads was causing great anxiety to the engineering and operating departments whose duty it is to look far ahead and provide for future developments Particularly was this true of the Grand Central Station, New York which forms the eastern terminus of the vast system of railroads which is owned and operated by the New York Central and Hudson River Railroad Company The old station, built in the seventies, with an annual capacity for handling twenty-one million passengers. was considered to be far in advance of its time, and sufficient to take care of a century's growth in the business of the company Thirty years after its date of opening, however, the company realized that traffic was advancing so rapidly that within a few years' time the Grand Central Station, in spite of its dimensions, would soon be swamped by the swiftly-rising tide of travel.

The company, however, was confronted by two serious lim itations, each of which presented an effective barrier against any great extension of the terminal facilities on the one hand, the station, being located in the heart of the city, was surrounded by property whose value was so bigh that any adequate was so bigh that any adequate purchase of real estate for the



Easterly facade of the new terminal building, showing Lexington Avenue as it will appear when the whole station yard area has been built over.

purpose of extending the area of the station at street level mount of the question; and on the other hand, the flory of treffic to and from the enlarged testions would be throttled by the limited capacity of the four-track tunnel under Park Araus.

Electricity, which has actived so many a problem in modes on many a problem in moter engineering, proved to be the perfect solution of this riddly. The electric motor, eitent and amokroleus, enabled the railroad aman to get rid at once of position out guess and the roar of the locomotive schaust. No longer was it necessary, for purposes of ventilation, to build the new station at street level and open to the atmosphere. Trains could be sent through the Park Avenut man at the could be sent through the Park Avenuthan is attion could be sunk below ground, the street level restored above it, and the whole area of the station yard covered with the residential and commercial buildings of a modern

And so the New Tork Central Company, acting upon the opportunity presented by the development of electrical traction, made large purchases of real estate, contiguous to the old station yard, and proceeded to prepare for the new terminal by making a vast excavation of feet in depth and 46.3 acres in a crient on the site of the old station yard. Even the 46.2 acres did not provide sufficient



The station building, 300 feet by 600 feet, rises 105 feet. Twenty feet above street level is a cab and automobile drivenup. At street level me the express trains. Below this are the suburban waiting room and concourse leading to the express trains. Below this are the suburban waiting room and concourse leading to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the public level me that the suburban waiting to the suburban wa

date the 21.8 miles of terminal trackend therefore the station was planned to cover define or levels, with a total area of 69.8 acres, tower level to be devoted to suburban traffic, the to the express long-distance service. d for the removal of the old station, with its cel and glass roof, and the substitution of a new eminal which should not

enty be able to accommo-date, if need be, some 30,-060 people, but should also pravide office room for e thousands of emolovees necessary to carry on the engineering, admin-istrative, and clerical

work of the company.

The construction of the station was enormously complicated by the fact that it was necessary to keep the whole machinery of the terminal in continuous operation during the building of the new work: and it is safe to say that the most creditable fact connected with this stupendous work is that it has been carried through simultaneously with the operation of the trains, which, except for some in confusion wh electrical service was first instituted, has continued without serious interruption night and day.

The plan of construction was to commence excavation at the easterly, or

Lexington Avenue side, and as fast as the work was carried down to grade, to erect upon it the steel work for the two new levels, lay the tracks upon it, and transfer the trains gradu-Comparative Statement-Principal Passenger Stations in the United States and Europe.

		Length Track, Miles.	Num- ber of Tracks	Num- ber of Plat- forms.
New Grand Central Terminal Pennsylvania, New York City Chicago & Northwestern, Chicago & Northwestern, Chicago & Louis Uaion Station Soston South Station. Washington Union Station. Cologus Londen Waterloo Station.	10.9 9.8 18.0 5.8	31 8 16 0 27 5.4 15 0	16 31 18 38 38 34 14 18 14	36) 111 8 16 19 18
London Waterloo Station Dressen Main Station Paris St. Lamre Frankfort, Main Station.	7.0 11.2 11.0	8.0 8.5	18 14 81 18	14 9

* Of the total 67 tracks these 46 have

ally from the old to the new levels. This plan has been followed with great success: and a few months ago the last of the express trains, after it had cleared

the Park Avenue tunnel entrance, swung over on to the upper deck of the new steel structure, and the demolition of the old station building was begun, followed by the blasting out of the last section of the rock excavation. In a few weeks' time the excavation will be completed and the last car-load of the three million coad or the three million cubic yards of rock will have been hauled through the Park Avenue tunnel and dumped on the river side of the New York Central Railroad tracks. where they skirt the Huda River far to the aerth of the city.

of the city.
Architecturally and sethetically, New York city
will be greatly advantaged
by the construction of the
see glation. In the first
lines, all the crosstown
acrossts, from Ferry-Skin
Fright-sixth, inclusive. he carried at grade ely across the station which will al

. ...

Fifty-seventh Street down to Forty-fifth Street, on the south side of which will be the north façade of the new station structure. From this point the traffic will pass around the station on a broad elevated driveway to Forty-second Street, which it will cross on a bridge of handsome design, continuing at grade till it joins the present high level of Park Avenue at

独物:

To the left are the new office building and the excavation for the tracks. To the right is the old train shed, now removed, and a part of the express traffic using the old high level. NEW STATION EXCAVATION LOOKING SOUTH

Fortieth Street. This broad, rectangular driveway. standing at a considerable elevation above Fortysecond Street, Vanderbilt Avenue and Depew Place, will form, as it were, a broad, elevated base, from which the huge station building will rise with a fine monumental effect.

By referring to our front page engraving it will e seen that, for the present, the station yard tracks will be exposed to view in the area north of the station; but ultimately these areas will be covered buildings designed to present a monumental effect, in which will be included museums, hotels, business blocks, and theaters These buildings will either be d by the railroad company and leased, or they will be put up by private enterprise. In the latter case the railroad company will reserve the right to exercise a strict supervision over the architectural estures of the buildings, which probably will be classical or semi-classical in treatment Ultimately, the whole space will be covered in, and on the site of the old and unsightly yard, with its smoke and dirt and noise, there will rise a new section of the

gity which, in the dignity and harmony of its architecture, will be unequaled in any part of the greater It is interesting to record that the rentals from these buildings will be sufficient to cover the interest on the vast expenditure involved in the construction of the new station.

The new terminal will have four levels, where the

old had but one at street level At the grade of Forty-second Street will be the gallery, below that will be the great con-course on the level of the forty-two tracks that will handle the through express trains On the On the twenty-five tracks for the suburban trains, and below these, running east and west under Forty-third and Forty-fifth Streets, will be subways for handling the inbound and outbound baggage

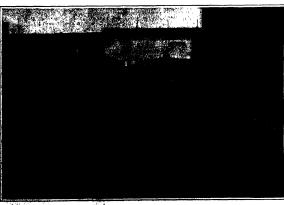
An important problem in building the terminal station is to separate the inbound from the outbound traffic, so that passengers and their baggage may flow in an unbroken stream from sireet to train or from train to To secure this unstreet obstructed flow has been the governing motive in designing this station. and an important element in the plan has been the total elimination of stairways and the substitu-

tion therefor of inclined passenger walks, or, as they are technically known, "ramps," which will be constructed on a grade of eight feet rise to every hundred feet of length With a view to avoiding congestion, no less than twelve separate entrances to the station are provided. The passenger purchases his ticket in the express concourse, and passing to the next counter, turns over his ticket and baggage checks to the transfer company, who send them by pneumatic tube to the baggage room, where the trunks are checked, and the trunk checks sent back. Passing through the gates on the side of the concourse opposite the ticket offices, the passenger walks down an easy incline to the express passenger platforms, which are at the same level as the floor of the cars, and boards his train.

The handling of baggage into and out of the trains

is entirely separated from the passengers, the incoming baggage boing unloaded beyond where the passengers leave the train, and the outgoing baggage being brought up to the baggage cars, at the front of the trains, from the subways already referred to

Following out the principle of segregation of classes of passengers, there will be two large waiting rooms adjoining the Forty-second Street enlong-distance passengers. another immediately below it for suburban service, each being on the level of the tracks which it serves Everything. ticket offices, entrances and exits for the express and suburban service, will be entirely distinct and separate, each having its own concourse its own information bureau, baggage checking places, parcel room, and other facilities for travel The concourse for travel The concourse for inbound trains can comfortably hold 8,000 people, that for outbound trains, 15,000. The walting rooms will accommodate about 5,000 more, and altogether this great sta-tion can take care of nearly 30,000 people with-out subjecting them to uncomfortable crowding. Ιt



10,800 embic yards of rock in sinking the tracks to the new level, 45 feet forthe right is the steel work for carrying the two levels of tracks for express and local trains.

VIEW OF EXCAVATION LOCKING NORTH

A Substitute for the Rate Increase

Economics of Scientific Management as Applied to the Railroads

By Charles B. Brewer

N OW that the railroads cannot increase their revenue by raising rates, it behooves them to look in other directions.

Mucli has been said and written about the high cost of living. Results may be looked for when more attention has been paid to what somebody has aptly expressed as the "cost of high living."

The bugic call was sounded when Mr. Brandies, the Boston lawyer, gave such wide publicity through the railway rate hearings to the movement of conservation of human effort practiced for some years by a few advanced engineers and manufacturers

from advanced engineers and manufacturers.
This movement, known as scientific management, has as its foundation stone a measurement of output. No great advance is probable in any line unless it be known beforehand exactly what has been done in this line—in order to know what it is we are striving to

cost figures from this manager's shops. As should have been expected, the reply did not give the information. In conclusion, the refusal recited how impossible compliance was—that such figures were accer given to one outside the commany, etc.

This secrecy as to cost accounts prevails in every branch of the industrial world. It is considered almost a breach of etiquette to mention the subject to one who may in any manner be considered a rival. The manufacturer, otherwise liberal in giving out information as to methods, thus locks from others and has others lock from him the door through which might pass illuminative information—such, perhaps, as might mean an immense increase in output for both.

It is true that, unless operating conditions are understood, the use of such information is often more

In ignorance of the widely divergent results made apparent in the table. It also seems worth wide because of some wonderful results in lowering costs known to the writer by exactly similar mathods—all of which were accomplished through correspondence only by the intelligent work of an occupant of the much ridiculed "swivel chair."

The tables show conditions that are nothing short of astounding. They provide a plentiful supply of pacemakers. A glance at the table marked "Signamary of costs of repairs per mile" will show that no road need be slighted. For aince no one road excels in more than one operation, every one can asleet at least two others for its pattern.

The Railroad's Objections to the Railciency "Doctors." Before discussing the table further, it is partinent



MAGNITUDE OF LEADING RAILROAD LINES OF THE WORLD REPRESENTED BY SIZE OF LOCOMOTIVES

improve on. Thus, as the trotting record has been lowered materially by using selected pacemakers, it will be possible to accomplish results in matters industrial when we have sufficient knowledge to select the returning

the nucernakers for each particular branch. Nothing stands in the way of selecting industrial pacemakers as does the cloak of secrecy thrown around the accounting departments. In this connection I often recall a remark made to me a good many years ago by a companion in the engineering office of one of the large steel plants. He was a Norwestan, only a few months in this country, and had come to our office from the engineering department of one of the great trunk lines. A habit of prying around rival shops possessed him. "A stance" said he "will tell anything and everything about his business so long as he can make it appear he knows more of the subject than you." This remark would, in all probability, have been modified had my friend's experience included quisning of the "Yankees" about the coast of their work.

cost of their work.

Only a few days since I was shown a newly written letter from the vice-president and general manager of one of the big railroads in answer to that of an acquaintance who had had the tamerity to ask for

than useless. It is sometimes even dangerous. Costs as a measure of output are, however, the readiest measure of accomplishment that we have in industrial matters, and a free exchange of ideas along this line often opens up a mine of information as to destrable often opens up a mine of information as to destrable methods, efficiency of workmen, efficiency of machines, and many other matters of highest importance—not the least of which are inhorent faults with many systems of accounting. If there is anything about which secreey should not be observed, that thing is the cost of manufacturing. Such secreey is a stumbling block to those practicing it and to the whole engineering profession.

When that letter of refusal from the vice-president and general manager was being written the lake scarcely dry on aworn attaments giving the identical information requested of my acquaintance which this manager's read had sent to the Interatts Commerce Commission in answer to the order of the commission of October 31st, 1910.

The comparison of the costs of this manager's shops, with those of twenty-two other rallroads, forms the theme of this article. Their publication seems worth while, because it is fair to assume that this 'ever-pervading secreey has kept the different reads

to remark on some of the objections raised by the railreads to the introduction of efficiency methods advocated by Mr. Brandies' witnesses. After the baid assertion the railroads cannot apply these methods, one of the principal objections is that specialists are essential and that the supply of such specialists are essential and that the supply of such specialists are estremely linglied. Another is the time required to put the methods in force. A very considerable part of this time is required in accurately assertanting, output—in determining the measure for the pacemaker. The method of assertaining the output is to place stop watches in the hands of trained experts. Of necessity, this method is slow at best.

Still another objection is that the orders of these specialists must be supreme. And this requires that interjection of outsiders between the management and their employees. Another is that the specialised knowledge of these experts is of such high order itsis, it does not stick with the ordinary mechanic after the withdrawal of the expert.

These are only some of the more important objections. All of them do not seem to be well taken.

Luckily, however, there is a way to promote as immense amount of tendency and cases all the objection which the railroads have related. As has been deep

from they heed not go octained of their own large mailty. Octainity it is not unreasonable to expect plant these relieved can secondule what has already here accomplished by another railroad. The tables may been computed and tabulated from figures submitted by the railroads themselves. Even cursory estimization of them would seem to point a lesson to aday prudent railroad manager.

Pessible Savis

Without attempting to give advice to any of these managers as to how to run their beainess, it would seem from an examination of the table of locomotive repairs, for example, that the Eric could, with profit, send their hoomotive repairs men to investigate the shops of any of twenty-two other railroads. In the matter of freight car repairs on these same roads, among which the Eric is the eighteenth on the list, there are seventeen freight car repair shops from whom the Eric can get information of value. Likewise, in the matter of repairing passenger care there are sixteen available fountiation of information.

If after such an investigation the Eric attained the low cost per mile for her repairs aiready attained according to their own statements on the Minneapolis & St. Louis for locomotives, on the Toledo. St. Louis

I am ware that it can be argued that the policy of one road for leisting for rolling stock run down and another for keeping its in prime condition will account to a coptain extent for the large differences. This argument might possibly apply to a single set of figures. It can exceed yapply when all are so different. And against such an argument can be cited the costs of individual items of repairs submitted at the same time by the difference roads which above even a greater difference than any recorded in the tables printed herewith. For example, turning loc-motive axies ten inches diameter ran all the way from eighty cents to fit owest road to five dollars for the highest; boilting up front ends of locomotive ran from fifty cents to four dollars and eighty-one cents; applying wheels to locemotives ran from sixty cents to eight dollars and thirty-five cents, and so on. These examples cited are those showing the greatest differences. It is not within the scope of this article to print all the answers to all the detail opprations, but it can be said that in practically all matters there ran a very wide divergence between the cost of the highest road and those of the lowest. And like the repairs that are tabulated for locomotives.

Locomotive Repairs -- April to September, 1909

Name of Road.	Locomotive Miles.	Cost of Lecomotive Bepairs.	Cost per Mile	Percentage of Increase Over Lowest.
Minneapolia & R. Louis Glosson, M.J. & M., Tamistern Chicago & Northwestern Chicago & Northwestern Chicago & Altion Deston & Maine Deston &	1.181,982 1.1012,647 17.947,553 9.337,101 10,088,582 11,586,129 14,684,131 22,042,276 16, 94,389 15,386,589 15,386,589 16,112,543 7,812,418 1,019,697 7,109,721 14,551,989 6,043,742 8,018,743	\$88,801 1,190,850 91,219 1,190,065 275,145 907,065 404,750 2,084,108 1,592,342 618,205 824,171 1,792,342 618,205 824,171 1,792,184 1,782,184 1,782,184 1,1983,263 1,1	7 8 8 8 8 6 6 7 8 8 8 8 6 6 7 8 8 8 8 6 6 7 8 8 8 8	Low. 8 14 14 15 18 19 31 32 33 40 46 70 70 82 100 107
Philadelphia & Reading . Delaware & Hudson	7,957,714 4,307,858 11,069,486	1,171,025 688,17.4 1,948,043	16 1 16 1 17 7	123 123 1 6

The tables are taken from the figures for six months of 1909, and were those first made up. In order to



GRAPHICAL COMPARISON OF THE BOLLING STOCK AND FREIGHT AND PASSENGER TRAFFIC OF THE WORLD'S LEADING RAILROADS.

& Western on passenger cars, and on the Chicago & Alton for freight cars, her costs for these three items would be changed thus:

	Present Cost to Bris.	Possible Cost to Erie.
Locomotive repairs: Passenger our repairs. Preight our repairs.	\$1,848,943 \$86,819 1,449,467	8794,186 87,569 586,904
Totals	\$6,890.249	\$1,408,489

Here then is apparent a possible saving for this one read of over two million and a quarter for a period of six menths, or over four and on-half million dollars (34,50,000) for a year. A wonderful opertunity awaits the establishment of some central committee.

Communes.

(Hance at the percentage of difference between the various roads at the right-hand side of the table, raining as they do up time several handesed per cent. Now compare these with the eight, ten or treatly per owing president by some presenting company—and resimpler; that; much promises at once status such a complete, the such promises at once status such a complete of the publication of the complete of the publication of the complete of the complete of the publication of the complete of the com

peat day after day and year after year. It should be noted that the figures are based on miles of travel and not on length of road.

The figures given for the Eric show the possible savings for a single road by simply using methods already in vogue in the shops of other roads for work of exactly the same nature. The twenty-three big raincade given in the tables represented about one-quarter of the mileage made by all the roads in the country. The total for all y all the roads in the country. The total for all y all the line, one hundred and forty-one million of boometives, about five hundred million miles for passenger cars and six hundred million miles for registic cars.

If the highest, lowest and average figures per mile of the twenty-three reads are applied to the mileage of all roads in the United States, there would be this startling difference in cost:

	Possible Cost (All Roads), Using Highest Figures per Mile.	Possible Cost (All Bonds), Using Lowest Figures.	Cost if Aver- age of \$8 Road is Used.
Locomotive repairs. Passenger our repairs. Freight our repairs	\$5,600,000 \$5,600,000	\$100,000,000 \$, u1,000 51,0.0,100	\$128,000,000 27,500,000 186,800,000
Totala., (1.,	\$488,020,000	\$1.48,000,000	\$995,7(0,000

see that there was no peculiar reason for the remarkable differences shown for that year, those for a similar period for 1910 were then tabulated. Space does

Summary of Costs of Repairs Per Mile—April to September, 1909

Name of Road.	Freight Car Repairs.	Locomotive	Passenger Car Repairs	Total Repairs.	Perce and P
	Cents	Cents	Cents	Cents	
Chicago & Alton .	8.5	8.3	44	201 2	LOW
Toledo, St. Louis & Western	14 0	8.2	1.8	24 ()	110
Chicago & Northwestern	18 3	N "	4.6	25 1	25
Pere Marquette.	13 8	8.7	4 6	27 i	84
	34 6	8.6	5.6	2H H	431
Boston & Maine	15.5	8.5	A 2 5 8	201 2	45
Minneapolis & St Louis	16 8	7 2	5.8	29 8	45
Chicago, Minn. & St. Paul	17.8	7.8	4.3	80.0	4A 57
Chicago, R. I & Pacitic Wabash	17.8	9.8	4.0	31.6	57
Wabash.	11 5	10 5 13 1	3 7 7 4 4 2 7 6	81 B 84 7	58
Iowa Central	14 2 23 5	96	1 2		72
Chicago, Bur. & Quincy	16.5	14 4	7 6	98 3 98 5	(40)
Missouri Pacific Delaware & Hudson	17 6	16 i	61	85.8	91
	227	12 9	40	39 6	98
Haltimore & Ohio	220	10 1	8.8	40 9	108
Del., Lack, & Western Atch., Topeka & Santa Fe N. Y. Central & Hudson River	18 5	14 9	96	43 0	114
V Cambral & Bushum Disease	80 4	9.5	5 6	44	121
Brie	28 8	17 7	61	i i	184
chich Valley	28 8	15 0	58	48 6	141
Pennsylvania	80 4	15 5	5 1	48 6 61 0	186
	84 7	12 2	7.0	53 9	10%
Philadelphia & Reading	86 4	16 î	9.6	61.9	207

not permit the publication of these tables for 1910. It can be stated, however, that although the figures were changed slightly because most of the roads raised wages during the intervening period, the same general variation obtained; the highest and lowest fig-ures for that year (1910) being 171/2 and 8.1 cents per mile for locomotive repairs, 8.7 and 2.5 cents per mile for passenger car repairs, and 34.1 and 103 for freight car repairs.

It would have been interesting to have had the rates paid workmen published along with these re-markable differences. Some light would probably have been thrown on the relation between high or low costs of work and high or low monthly wage rates of the workmen I say monthly wage rates, for when work is paid for by the piece the unfortunate and widely prevalent custom of cutting piece often results in all sorts of deception on part of the workmen. And a high hourly rate one day will be followed by the workman decreasing his out-put the next. He feels, and with justification, that put the next Ho feels, and with justification, that the rates will be cut if he is able to make an unusu-ally high amount in a month Diminished output of the workmen, with attendant expensive delays, are the results, all of which are paid for dearly by the stockholders

It would seem from the tables that there is ample opportunity for the railroads to recover several times the twenty-seven million dollars expected from the rate income by effecting reform from within

After all roads have attained the lowest figures of "low" road by using that road's methods, the habit of saving will probably have become so fixed that perhaps the "efficiency doctors," as they have been called, will be sent for,

Transcontinental Railroads in the United States

(Continued from page 589.)

Union Pacific and the Atchison, Topeka & Santa Some idea of what this competition and the potential and often active competition by water has done for freight rates may be gained by under-standing that the rate on first class freight from New York city to San Francisco is \$3 per 100 pounds, or \$67.20 per long ton, while the rate on fifth class (highest class) merchandise from London. England, to Birmingham, about 125 miles, is 49s 4d (\$9.84) per

Transcontinental freight rates are really much lower than is shown by this comparison, because only a very small part of the freight that moves from the Atlantic seaboard to the Pacific coast moves on what are called class rates; and even at these rates only a small part takes the first class rate, there being six classes, and each succeeding class is proportionately The great bulk of the freight moves on what are called commodity rates; that is, so much per 100 pounds is charged for a certain commodity—oranges, for instance, or lumber, and commodity rates in gen-

for instance, or tumber, and commodity rates in gen-eral are much lower than class rates. Competition and the genius of American railroad men have worked along the line of reducing the charge for the freight business, and the results are probably more strikingly shown by the transcontinental roads than by any other class of roads.

Competition and the genius to meet this competition have been just as active in the passenger business as in the freight, but with the result that instead of reducing the cost per passenger per mile as the cost per ton per mile for freight was reduced, the railroads have found that what the public wanted was not so much cheaper passenger rates as a very high class of service. Of course, in the case of each one of the transcontinental roads the freight business is a far more important source of revenue than the pas senger business, but the passenger business is absolutely essential to the roads; and to the great ma-jority of the public, passenger service is the criterion by which the efficiency of any given railroad is indged

varying seasons have a considerable influence on the movement of freight over the northern or southern lines. For instance, oranges first begin to move cast from California in considerable quantities in the early part of January At this time the southern-most route, the Southern Pacific, can bid successfully for the business A little later the Atchison, Topeka tor the outsiness A ratio meet the Arcusson, 10 peak & Santa F6 puts in its bid also for this business, and by the time spring has come the Southern Pacific-Union Pacific route, through San Francisco and Ogden to the East is hauling solid trains of oranges.

In the summer the northern lines—the Northern Pacific, the Great Northern and the St. Paul—get their share of the fruit business, canned fruits, dried fruits, apples, etc., moving from California to the

The seasons make a big difference also as to which

Millerson	Facilie.	Horisten.	Pacide.		1
\$55,600,000 \$64,625,661 1,667 1,917 1,917	1,0079 5,514 \$546,000,000 1,490 14,905 18,995,906 5,419,084,965 997	1,659* 7,660 9609,410,900 1,197 606 64,600 80,804,973 5,678,787,816 945	1,784 (5,401 (618,804,809) 1,184 (81,608) 11,618,911 18,618,914 (81,607,918,604 400	7,114	10.007 10
18,189,861	9,689,994	8,848,557	8,806,600	18,075,865	1 M. 18 M.
2.50 1.88	\$.18	9.90	9,198	9.66	8.19
	8.60	#1714 #1715	### 1746 ###	### CASE CASE	### CASE

"The length of main line is from eastern terminas to western terminas of the route "The Chicago. Milwaukee & St. Paul main line runs from St. Paul The Observation of the Novem. This lecitodes the Chicago. The Chicago. Milwaukee & St. Paul main line runs from St. Paul The Northern Paulein main line runs from St. Paul to Tacoma. "The Great Northern main line runs from St. Paul to Tacoma. "The Great Northern main line runs from the Paul to Tacoma. "The Great Northern main line runs from the Chicago. The mileage gives in our table is the main line mileage from Council Birdie to Odes." The mileage gives in our table is the main line mileage from Council Birdie to Odes. The mileage gives in our table in the main line runs from New Orieans to San Prancisco. "All of the figures in this colours are the total Sparce of the fit. the figures for capitalisation, and the averages for length of

route gets the bulk of the passenger service. In the summer the St. Paul and its northern neighbors—the Northern Pacific and Great Northern—can flood the New York city ticket offices with highly colored literature describing the cool breezes, the cool nights and the magnificent scenery on their lines. In December and January the Southern Pacific's southern route, which in point of time cannot compete at all with the other lines, gets nevertheless a large passenger business because it can offer the prospective traveler a journey through the semi-tropics almost all the way from New York. The Southern Pacific's southern route for passengers is to take them by boat from New York down into the Gulf of Mexico and transfer them at New Orleans to trains.

Few people realize how keen this competition for enger traffic from the eastern cities to California has become, and few indeed realize how much the railroads have done, or in how many little ways they have extended their activities in order to make their road the more attractive. The fact, for instance, that the Yellowstone Park is on the line of the Northern Pacific is as truly an asset of the Northern Pacific's as is its passenger station at Scattle; the fact that the Grand Canyon of Colorado is on the line of the Atchison, Topeka & Santa Fé is as truly an asset of the Atchison's as is its interest in the union passenger station at Los Angeles.

A very interesting development for instance in this competition for the California passenger business is shown in the case of the Atchison and the Southern Pacific in the development of meal service. The Southern Pacific, taking its hint from the deservedly well known and well advertised Fred Harvey meals, has made its own dining car service, apparently regardless of cost, an achievement truly to be proud of. The money loss from operation is more than made up by the gain in popularity.

The ordinary traveler does not make the trip from Chicago to California so often that he can form any fair judgment of the percentage of through trains that are on time. His judgment is based on a single trip, and if, therefore, his train is two hours late, he feels at least, that the A. & B road that he has traveled on usually has its trains two hours late Since there is no double-track transcontinental road at present, although the Union and Southern Pacific are planning to have their connecting lines between Ogden and San Francisco double-tracked, this fast passenger traffic has to be handled over a single-track line, slready pretty fully taxed to take care of the local passe and local and through freight business. Nevertheless, the road's reputation, and therefore the passenger department's ability to get increased business, depends on getting the fast train through on time, and the efforts on the part of the operating man that are used in doing this are sometimes almost beyond belief,

One of the first things that a traffic man wants to know about a road is what commodities it carries. An expert can get a pretty good idea of this from studying a map of the road. Most roads report the tonnage of each general class of commiddities to their stockholders in their annual reports, and all roads are required to report this to the Interstate Commercia

Commission.

Of the total tonnage carried on the Great Northern,
19 per cent is products of agriculture, such as grain
and so on. Of the total tonnage of the Northern 28cific, 19 per cent is products of agriculture; on the Chicago, Milwaukee & St. Paul, 19 per cent is predicted of agriculture; on the Union Pacific, 24 per cent is products of agriculture; on the Denver & Rio Granda, heal, train load and receipts per passenger per mile. The \$494.618.231 cupital is the outstanding capital of the Getera. Mireauxes at X. Trul, and the \$25,000,000 represents the training at the state of company materials is thoughout training training training at lamburgh affected or not. To Constitute training training training at lamburgh affected or not. To Constitute training training at the analysis of the passenger of the pas

4 per cent; on the Atchison, 28 per cent, and on the Southern Pacific, 20 per cent.

On the Great Northern, live stock and animal products, such as dressed meat, etc., form but 1 per cent of the total tonnage; on the Northern Pacific, 2 per cent; on the St. Paul, 5 per cent; on the Union Pacific, 6 per cent; on the Denver & Rio Grande, 1 per cent; on the Atchison, 8 per cent, and on the Southern Pacific, 4 per cent.

Products of mines furnish 58 per cent of the total fronucts of mines furnish so per cent on the tonnage of the Great Northern; 24 per cent on the Northern Pacific; 32 per cent on the St. Paul; 34 per cent on the Union Pacific; 84 per cent on the Des & Rio Grande; 28 per cent on the Atchison, and 28 per cent on the Southern Pacific.

Lumber and products of forests furnish 12 per cent of the total tomage on the Great Northern; 38 per cent on the Northern Pacific; 18 per cent on the set on the Northern Pacine; 18 per cent on the St. Paul; 14 per cent on the Union Pacific; 2 per cent on the Denver & Rio Grande; 12 per cent on the Atchison, and 21 per cent on the Southern

Manufactures furnish 6 per cent of the total ton-nage on the Great Northern; 10 per cent on the Northern Pacific; 18 per cent on the St. Paul; 13 per cent on the Union Pacific; 6 per cent on the Denver & Rio Grande; 17 per cent on the Atchison, and 17

per cent on the Southern Pacific.

This is all carload business, that is, each shipment consists of at least one carload. The less than carload freight business is generally called merchandise, and of the total tonnage of freight carried by the Great Northern but 3 per cent was merchandise; by the Northern Pacific but 5 per cent; by the St. Paul but 10 per cent; by the Union Pacific but 5 per cent; by the Denver & Rio Grande but 1 per cent; by the Atchison but 7 per cent, and by the Southern Pacific but 8 per cent The rest of the total tonnage, besides the carload business that we have classified, and the miscellaneous less than carload business, called mer-chandise, is made up of miscellaneous carload thipments. It should be noted here that the very high percentage of products of mines, carried by the Denver & Rio Grande, is caused by the great quantities of ore which the Denver & Rio Grande hauls out of the mountains in Colorado, and this business is not tran continental business in any sense of the word. course, in giving the above averages, it was impossible to include the Western Pacific's or Missour! Pacific's business with that of the Denver & Rio Grande, and we have not included the St Paul's Pacific Coast exwe have not included the St. Paul Staff. The tension with the figures for the St. Paul Itself. The only way to get any comparison between roads of different lengths as to what they are earning, is to reduce earnings to a per mile basis. As a matter of fact, a per mile basis does not make even a fairly accurate comparison. Difference in conditions, differ-ence in commodities carried and differences in physical location must be taken into consideration to make any sort of comparison, so that there is shown here-with total earnings in the year ended June 20th, 1910, of each of the roads discussed:

nual reports, and all roads are	•	Total, In-
to the Interstate Commerce		ger clud'g Mail,
sarried on the Great Northern,		ue. Murrese, etc.
sarried of the Great Mortueks.	Great Northern \$46,675,784 \$17,635	,062 \$64,44K,270
of agriculture, such as grain	Northern Pacific., 48,758,728 24,250	218 74,255,256
	C., M. & St. P 44,909,187 18,009	198 44.844.894
oducts of agriculture; on the	Union Pacific \$1,679,680 25,884	354 25 500 465
t. Paul, 19 per cent is products	D. & R. G 17,500.611 CAM	
Union Pacific, 24 per cont in	A. T. & S. Po 71,284,855 (\$2.015)	424
on the Denver & Rio Grande.	Southern Pacific. VI. 512 Str. of Str.	The state of the state of
All had a	The same of the second section of the second section of	an en l'expension année :
98 38		

Hygroscopes—Quaint and Curious

By C. Fitzhugh Talman

MOPERLY speaking, the duty of a hygroscope is a modest one viz., to show whether the air is y or moist—while to the hygrometer is assigned the ers difficult task of measuring atmospheric mois-ers. Owing, however, to the fact that the approach of a baremetric depression, with its attendant rain or anow, is accompanied by an increase in the or snow, is accompanied by an increase in the humidity of the air, the hygroscope serves as a rough sized of weather glass, and, in some of its forms, is often referred to as a "barometer."

The great majority of hygroscopes are mere toys; but since they are in common use the world over, and are often very ingeniously devised, science cannot afford to ignore them, but should rather endeavor to enlighten the public as to their true character.

A great number of substances possess in a marked egree the property of absorbing moisture when the air is humid, and giving it out again when the air es dry. Such substances are said to be hygroscopic. Their property of changing their condition in scopic. Later property of changing their condition in response to changes in the humidity of the atmosphere is taken advantage of in the construction, not only of hygroscopes, but also of many forms of hygro-

The twisted fibers of hemp, catgut, etc., resorb moisture, swell, and cause a longitudinal shrinking of the ropes and cords made of such materials This fact is illustrated in the familiar anecdote of the erection of the Egyptian obelisk that stands in the middle of the square facing St. Peter's at Rome. The following is one of sev

eral versions of the story:

"The obelisk consists of a single piece of red granite, more than 85 feet high, and 9 feet square at the base. It had been thrown down during the decline of the Roman Empire, and had remained under heaps of rubbish during many centuries. After several futile attempts centuries. After several futile attempts, the huge block was suspended in the air, and as the ropes which held it had somewhat stretched, they could not make the base of the shelisk reach the sum mft of the pedestal, when a man in the crowd called out, 'Wet the ropes'

was done, and the column, as of itself, gradually rose to the required height, and was placed on its pedestal."

If a weight be suspended from a cord, moisture will not only tend to lift the weight, but will also give to the cord a twisting motion.

ing and twisting—explain the operation of some of the most interesting forms of hygro-scope. An illustration of the former is seen in the Capuchin (Fig. 6). A bit of catgut within the figure is attached immovably at one end, the other end being fastened to the monk's cowl, which is hinged at the back. When, in consequence of

the increasing moisture o f the atmosphere, the catshrinks, cowl is the monk's head, who fato prepare himself for wet and stormy weather. When ut length-

-

her house was invented about 1700. It was a more familiar object in American homes fifty years ago than it is to-day. It consists of a catgut cord, from which is suspended a little horizontal platform of wood, bearing the figure of a man at one



Fig. 1. -- The "Chameleon Barometer. hygroscope.

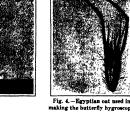


Fig. 2.—The silver-foil hygroscope



Fig. 3. - The butterfly hygro-







在2000年1日,11月2日日,11日



.—The "Weather Capuchin."



Fig. 7.-The Dutch weather-

side and that of a woman at the other. Sometimes the man carries an umbrella, and the woman a fan or a parasoi. In an average condition of atmospheric humidity both figures stand inside the house. If the air grows moister the man emerges from the door, if dryer the woman; these movements being due, of course, to a slight change in the twist of the cord the Germans these figures are called, respectively,

the Gormans these figures are called, respectively, Wettermichen and Witternichen the firm the famous Wetternington (Fig. 5), a chandeler bearing female figure banking in the Rathhaus of Rottenburg, Bavaria The chandelier hangs from a hempen rope. In moist weather the figure taces the window, in dry weather it turns in the opposite direction

Many plants possess hygrosoph properties. The common pimpernel (Anagallis arcusis, L) owes its sobriquet "poor man's weather glass," or "shepherd's sobriquet poor mans weature glass, or "simplered's weather glass," to the fact that it is reputed to close its little scarlet blossoms before rain. It is the ex-perience of the present writer that this prophelic faculty of the pumpernel cannot be depended upon, at least in America, for he has often found the blossoms wide open both before and during a shower are, however, several other plants that exhibit hygro scopic movements whenever suitable conditions exist The beard of the oat is decidedly hygroscopic, and has often been used in the construction of hygrometers and hygroscopes Lana, in 1670, fastened a bit of convolvulus stem vertically at the bot-

tom of a little tube or vase, around the rim of which was placed a divided circle A light figure of a man was at-tached to the stem, and as the latter twisted a spear in the man's hands pointed to successive graduations of the scale, in humidity indicating various degrees of

Two curious forms of apparatus, the Two curious forms of apparatus, the butterfly hyproscope and the foil hyproscope, were described a few years ago by Mr Richard Inwards, the well-known

English authority on weather folk-lore.

The former of these utilizes the hygroscopic properties of the awn of the Egyptian wild out (Fig. 4), the lower part of which twists about with variations in the humidity of the atmosphere Fig 3 shows one wing of the butterfly-made of paper, painted in water colors. The lower end of an colors The lower end of an awn is fastened down by the screw shown at the left, the upper is attached to the wing The other wing is attached to another awn, which, however, must be turned in the opposite direction. It is best to set the wings on a very damp day, when after loosening the screws, the wings may be pressed to gether in a vertical position, and the screws lightly turned so as to hold them there With a little experimenting, it is easy to adjust

this philo-sophic toy in such a manner that the wings will expand in dry weather

The foil hy-The foil hygloscope (Fig.
2), which is
said to be one
of the most
sensitive devices of its
class, is best
described in Mr. Inwards's own words

"It consists of three slips of the foil used by jewelers to enhance the effect of (Continued on page 810.)



Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

False Appearances Produced by the Stereoscopic Combination of Comet Photographs

In the monthly notices of the Royal Astronomical Society Frof. E E Barnard discusses certain false appearances which may be produced in the preparation of celestial stereo-photographs owing to the differential motion, for instance, of the different parts of a contel Frof. Bannard wyites:

he stereoscope enables one to see objects in p spective by the combination of two photographs taken from a slightly different point of view. accomplish this effect is to shift the position and direction of the camera by a proper amount between the taking of the two pictures. Essentially the same efwould be produced by the bodily displacement of the object with the camera stationary, provided all of the background were itself too distant for parallactic displacement Both these methods would require that there were no relative change in the individual parts of the object in the interval between the two pictures. For celestial bodies, where our base line is too small to give any appreciable parallax, the last of the two methods is resorted to. In the case of the Moon the perspective is obtained by the sid of libration; and as the phase has to be exactly the same, a very long

interval is required. In the terval of an hour, or of a prope motion star of several years. will produce the required ef-The short interval is also applicable to a comet, and beautiful and startling effects are produced by this means in the case of a comet with a tail. Few bright comets, however, are above the horizon long enough to permit the two photographs to be made for this pur-On account of its high north declination, and its con sequent visibility through all or nearly all the night, comet c 1908 (Morehouse) was speci-ally suited for stereoscopic ally suited for stereoscopic photographs, and the material acquired for this purpose is abundant. The combinations of proper sets of these pictures the comet in beautiful relief suspended alone in space as we know it is in reality, with the various parts of the tail in individual perspective. There is a wonderful effect of reality in these pictures, and the filmy, breath-like character

of the comet is shown as no single picture can ever hope to show it These photographs are marvelously instructive, and one is tempted to deduce certain facts' from the appearance which are probably entirely erroneous.

"This is such a serious matter, and one so fascinatingly delusive, that I have thought it worth while to draw attention to the chances for serious errors that are inherent in the very success of the experiment in the case of a comet.

"I have combined a number of photographs of the present comet, in which the motion in an hour or so, between the exposures permits stereoscopic effect One of the most remarkable of these combinations is one of 1908, October 15th. On this date there was a sudden twist or break in the tail, which formed ir-regular cloud-like masses that moved out from the comet along the general direction of the tail. scope these two pictures produce an exquisite object suspended in front of the stars Apparently it is easy to see which are the farther and which the nearer parts of the comet. The south end of the long irregular mass at an angle to the tail is the nearer, From this the tail has a twisted or corkscrew form, the nearer and farther convolutions of which are at once evident The straight stem-like tail emanating from the head passes behind this mass. On each side of the head is a small stream shot out at a, considerable angle to the main tail The south one of the apparently recedes from us at a large angle to the

"But how much of this perspective is real? I believe that there is but little of it that can be true. In the first place, these masses were receding from the comet and changing their actual forms, and especially their position angles, so that a pseudo-stereoscopic efcit would be produced, and what is really the nearer portion of the comet may appear to be a distant part. Some of the features where the details were not changing rapidly—as, for instance, the short tail from the south side of the head—would probably not be affected much by the outgoing particles, and a true atereoscopic effect would be produced. I have my doubts about much of the reat.

"In connection with this subject I would say that I never need the stereoscope to combine these pictures. By a certain control of my eyes, any stereoscope picture is far more beautiful without the stereocope, and I never use the instrument. The magnification of the image is somewhat less. When one has this command over his eyes he will never again use a stereoscope.

"While I believe that a good deal of the prespective on these storeograms is untrue, and that it does not accurately represent the actual appearance of the comet at the time, it must not be understood that would discourage the atterageable study of cometa. I believe that much can be learned of the general structure of these bodies from such a study. We must simply be guarded as 60 the relative perspective of the various parts of the comet at that time, as result-

Sercourage by Poul E. S. Barased.

STEREOSCOPIC VIEW OF MOREHOUSE'S COMET, 1908.
Cut this out, paste it on cardboard, and view it in your stareographs

stand the features of comets in general

ing from a combination of the two photographs.
"Though the appearance, in a stereograph, of any one comet may be partly false, there is certainly no other method that can show us how a comet really looks in space; and for this reason, if for no other, it will, I believe, in a truthful manner, help us to under-

Standardized Operations and Scientific Management

I N a most readable and instructive article in the Engineering Magazine. Mr. Harrington Emerson shows what standardization means in efficiency engineering.

"Moses came down into camp with his tables of stone and the ten commandment," says Mr. Emerson.
"It took one minute and fifty seconds to read them slowly and impressively. Moses expected that the tribes assembled would listen, practise, and become perfect before they reached the Promised Land. Thirty-dwe hundred years have clapsed and the breach of most of the commandments is still very popular. It is because the virtues excibed are not obvious, or instinctive, that they have to be graven on stone, that they have to be repeated weekly if not daily, that they have to be incorporated in our codes and enforced by our courts.

"The rope is made of many minor strands; these are twisted from the numerous threads, and these in turn have been spun from broken and careled fibers. The sheep's fleece is a unit, a matted mass flast adheres and forms a whole, not because it is wowen like a blanket, but because of its intervence conficusion and tangle. There is no popular English werd:

for a single thread of wool. Poli one took and the whole fleece comes, not because of orderly connection, but because of disorderly taugle.

"The march of a regiment is one thing, the surge of the crowd that jostles and sways us and upsets all orderly progress is another thing. The sheep is a silly creature, the only animal that would perial without the care of man, so no wonder its fleece is The matted, tangled hair of some sayauch a mess. ages, hair plastered with mud, is comparable to the fleece, but civilized man settles the problem by clipping his head hair so that it could not tangle if it tried, settles his face hair by shaving off every vestige of it three to six times a week; but woman, more patient, with more capacity for taking pains, s and combs out her long locks, beginn the ends, straightening a few inches at a time, than reaching higher up, rearranging all the parts already perfected, and so back to the head, until each of the 40,000 separate hairs lies in its own appointed place as to all the others, and all contribute to the marvelous and intricate creations that as a whole crown her lovely head. If it were not for the ideal plan the would be hopeless. task would be hopeless. At least once a day does woman adjust her hair, the 40,000 single hairs to the eneral plan, and once a day should the 40,000 opera-tions of the shop be straightened

tions of the shop be straightened out in accordance with a general

"The separate operations in a shop must flow into the final output; but from the expected output backward, there must be a plan that reaches back to each detail of every operation.

"It is one thing to build as battleship, taking up details as they occur—the haphard method; it is another thing to make the plan first, place all the details where they belong in time, space, relation and perfection, and have them drop into place with the accuracy of a watch movement—the difference, in fact, between the running of sand through an unstandardised aperture, and the precision of the chronometer. Good results are not achieved by chance are not achieved by chance.

"One volume of the standardpractice instructions covering the manufacturing of the grapline automobile truck car conciains 278 isometric designs or illustrations, 214 pages of printed matter, and spaces for the times and rates of 1,231 distinct opera-

tions. Each one of these operations was preceded by many designs until one was according to a sproximatory good. The design was split to have component parts, investigation made as piece, how strong it should be, what heat treatment should be given, on what mentiones it should be given, on what mentiones it should be given, on what mentiones it can be ach piece and operation many time studies are made, and finally from the mass of accurately ascertained or available information, a carefully preculted work-instruction card is made out. All these items of planning must precede the time and cost ratings. Are you appalled at the mass of detail that precedes the making of a boate? If we have but 100 copies to print it is chasper, quicker, and better than manuscript it where the copies to make it is better to choose the typewriter and provide carbon manifolds than to write it out by hand. If we want only 300 screws and it takes three hours to set up the subscript of the control of the co

"Nevertheless, the difficulties are very real and there is a middle ground between the optimizing that underrales them and the despair that refuses to meater them. There are between 8.000 and 18,000 are rate joices in a locomotive, and each railroad in this country wants a different design. One great raillyand and 184 different styles of hocomotives, so that posice is an expanding shock of sundarded; but the middle reason for beginning of colors.

of Svante Arrhenius in Regard to the Glacial Periods

the state of the s

CANTE ARREENIUS has advanced an inger theory to account for the glacial periods which here marked several stages of geological history. The serit radiates into space not only the heat which is receives from the sun, but also the heat which is coneted from its very hot interior. According to the periments of Langley, the carbon dioxide and the water vapor, which the atmosphere contains, are more opaque to the heat rays of great wave length which emitted by the earth, than to the waves of various of the which emanate from the sun. Arrhenius in fers that any increase in the proportion of carbon dioxide and water vapor in the atmosphere will inthe protection of the earth against cooling and will con equently raise the temperature of its surface. The theory assumes that the earth's atmosphere was poor in carbon dioxide and water vapor during the glacial periods, and rich in these gases during hot periods. It is interesting to see whether this ingentous and seductive theory, deduced from Langley's experiments, agrees with the results of various experiments made for the purpose of testing the theory, or with the general results of geological atudy

This comparison is made by Robert Douville in a recent issue of La Nature, from which we abstract the following:

The carbon dioxide contained in the atmosphere comes in large part from volcanic eruptions. Hence, if the theory is true, the hot periods in which carbon dioxide is supposed to have abounded should also be marked by great volcanic activity. On this point geologists are not in agreement, and a 1981y discussion has been carried on in Germany, where Frech is the principal champion of the theory of Arrhenius, which is attacked by Emm, Kayser, Philippi, and other geologists. It is very interesting to see whether things have really occurred as if the theory of Arrhenius wer If this is the case, the purely physical verifica tion of the fundamental hypothesis of Arrhenius will lose a little in interest It is conceivable that the theory might be verified more completely in nature than in the laboratory

The experiments which relate to the physical hypothesis of Arrhenius are too numerous to be reviewe here Arrhenius himself maintains that a diminution of the quantity of carbon dioxide in the atr phere by one-half would lower the temperature of the earth's surface by 9 deg. F., half of this reduction of temperature being caused directly by the diminution of carbon dioxide, and half by the associated reduction in the quantity of water vapor. Arrhenius studied the radiation from a body at the temperature of the isboratory to another body cooled to 112 deg. F., and which played, with respect to the first body, the part which interstellar space plays with respect to the earth. He found that the absorp the thermal radiation increased continually with the the thermal rankinton increased continually with the mass of carbon dioxide employed. The proportion of heat absorbed sometimes exceeded 30 per cent, and the interpretation which Arrhenius had first given Clangley's experiments was completely confirmed by his later experiments. The German physicist, Koch however, finds that the same mass of carbon dioxide absorbs more heat at high than at low pressure, a result which would appear, a priori, very unfavorable to the theory. But the experiments of Rubens and Ladenburg are the most important. They have been differently interpreted. Here are the facts. By studying with the spectroscope, the absorption bands pro duced by the interposition of a stratum of carbon dioxide of measured thickness before a body which emits long waves of "dark heat" it is found that there are three such bands, corresponding to wave-lengths of 2.6, 4.4 and 14.7 thousandths of a millimeter. The two thickness of the absorbing stratum of carbon dioxide ed, but the third band increases in width and thus gives evidence of increased absorption. The following table indicates the magnitude of this phenomenon, which accords with the theory of Arrhenius:

the theory of Arrhenius, estimate that this increase in absorption is too small to explain the glacial periods. This is not a necessary conclusion; but, at all events, the result of these experiments is contradicted by the result obtained by Kayser, who attempted to perimentally that at pressures higher than 8 inches experimentally that at pressures higher than 8 inches of sincerury, the amoust of shorough on influenced by facessaing or dissibilities the quantity of carbon decides. This physicist vidently peld no attention to the third absorption band.

"Geology Furnishes Hittle evidence on either adia.

The Shorty M Arrhentin sendres some august from

Topic was

the fact that the glacial periods of the Upper Carbonus, the Permian, and the Tertiary follow periods (Carboniferous, Upper Cretaceous) in which enormous tities of carbon were fixed in the forms of coal and limits and the quantity of carbon dioxide in the atmosphere was thus possibly diminished. The vol-canic eruptions of the Upper Permian terminated the glacial period which occurred between the Carbon-iferous and the Permian. This is the only geological evidence in favor of the theory of Arrhenius. The unfavorable evidence is more abundant. The Permian and Tertiary were periods of great volcanic activity, and, on the whole, hot periods, which accords with the theory, but there is no parallelism in detail between temperature and volcanic activity. The rich flora by ch we now know that the Tertiary period wa characterized, proves that the climate cooled progrescharacterized, prove that use elimate cooler progressively from the Oligocene to the Miocene, and from the Miocene to the Pilocene. Now, the Miocene was a period of very great volcanic activity, which should have prevented this cooling if the theory of Arrhenius is correct, or if the temperature had not been influenced by some factor more powerful than the quantity on dioxide in the atmosphere Similarly, a almost uniform and very high temperature prevailed over the entire earth at the Mesozoic epoch, as is proven by the sub-tropical fauna found in Lower Cretaceous deposits on the west coast of Greenland. This fact does not accord with the great infrequency of volcanic eruptions throughout the Mesozoic.

Moreover, it is not absolutely necessary to supp

that the glacial periods were caused by a lowering of the general temperature of the earth's surface, in connection with a reduction of the quantity of carbon dioxide in the atmosphere The unquestionable occurrence of many glacial phenomena in South Africa, Australia and New Zealand, has suggested the premature conclusion that the glacial periods were general or nearly so. It is very possible, on the contrary, that they were essentially local phenomena, connected with modifications of climatic conditions caused by changes in the distribution of sea and land.

The Wright Infringement Suit in France

HE Third Chamber of the Civil Tribunal of the Seine handed down an opinion, on the 29th of April last, on the validity of the Wright patents in France. Although the decision is by no means final, that the French courts are inclined to uphold the validity of the Wright patents.

s in this country, the point at issue was not simply the method of warping, but the use to which the ver tical rudder is put during the process of warping. It will be remembered that the Wrights never claimed to originators of warping a wing in order to preserve lateral balance, but that they did claim to have discovered the necessity of throwing the vertical rud-der over to the side of least resistance during warping, in order to prevent the entire machine from swinging around a vertical axis. In the earlier Wright machines, the vertical rudder and the warping devices were operated from a single lover, which was given a kind of elliptical motion in order that the might be warped simultaneously with the swinging of rudder.

The French preliminary decision involved the following machines and makers: Blériot, Koechlin, Clément-Bayard, Antoinette, Farman, Esnault-Peiterie, Fernandez, Les Ateliers Vosgiens, and La Banque Automobile. The court held that the French patent dated March 22nd, 1904, granted to the Wright Company, covered not only the simultaneous operation of rear vertical rudder and the warping devices, but also the separate operation of the two, so far as that oper ation was necessary to keep the machine on its course in straightaway flight. The defendants had sought to in straigntaway night. The defendants has sought to limit the French susignees of the Wright patent to a mechanism which would simultaneously warp the wings and work the rudder, leaving them free to employ warping devices and rudders which were not interconnected. "In the patent of 1904," said the court, interconnected. "In the patent of 1904," said the court, "the action of the warping devices with the rudder operating devices is described so minutely that it can be understood and applied by engineers and aeropl constructors; there is no reason to believe that the Wright brothers should have claimed their combination more broadly, and should have specifically covered the separate operation of each of the elements.

. . After the patent of 1904, the invention consisted in a method to maintain or re-establish the equilibrium of the seronautic apparatus, and to guide the machine in a vertical or horizontal direction. Among other plements the patent provided for (1) two horizontal surfaces called wings, constituted by nes on which fabric was spread, and connected with one another by posts and articulations which permitted the movements of flexion and torsion at the ends of the wings/in an invarse direction; (2) a vertical movable rear rudder connected with the cable by means of which the wings were warped . combination of the two elements evidently falls within the scope of the patent, inasmuch as it is there said (lines 4 to 19, page 3): By this means of fixation the same movement of the cables which actuates the end of the wings also presents to the wind that side of the vertical rudder which is turned toward the side having the smallest angle of incidence" Continuing. the court remarked that the dissociation of the two elements claimed fell within the scope of the patent of 1904, and that since the independent operation of the warping devices and the vertical rudder was a natural development of the original invention, the patentees or their assignees alone should be privileged to enjoy the improvements made.

In 1907, the Wright brothers took out two other French patents, in which warping devices and vertical rudder operating devices, functioning indopendently described and claimed, but providing that the two elements could be operated together, if necessary. These two patents of 1907 repeat much of what is contained in the patent of 1904, and for that reason the was inclined to construe the later patents as embodiments of improvements on the

Convinced though it was that the French Wright patents were valid, and that most, if not all, of the defendant companies were infringers, the court was not inclined to hand down a final decision. It thought it advisable to ascertain whether there might not be one or several anticipations of all the elements described in the patent of 1904, and whether it might not be possible for the defendant companies to show that they could manufacture machines which would avoid the Wright claims The court felt that it needs expert opinion to assist it in deciding whether or not the Wright brothers were the original inventors of the apparatus in which they made their famous flights in France in 1908. Three experts were appointed for that purpose, Messrs. Leauté, Commandant Rénard and Marcelle Deprez, to ascertain if there were any anticipations of all the elements in the combination described in the patent of March 22nd, 1904, and in the case of a negative result, to determine if the structural parts of the machines of the defendants are infringements of the Wright invention and to be considered as accessory improvements of that tion; or if, on the contrary, there are essential differences between the characteristic elements of the defendants' inventions and that of the Wrights

New Researches in Stellar Evolution

PROF J C. KAPTEYN, director of the observatory of Groningen, in an address to the Thirteenth Dukel Science Congress, which met in that city in April, has made public some exceedingly interesting facts con ected with the delicate researches by which he (sim ultaneously with Eddington at Greenwich) dis-covered the dual character of our stellar system.

These facts were discovered in the course of a study of those stars which give the greatest promise of tending our knowledge of the real constitution of the universe. In particular, Prof. Kaptyen made a careful study of the star drifts formed of stars of the same tral type, especially of the helium stars and the stars designated as types I, and II. These three types form a chronological series, the helium stars being the oldest.

From a comparison of the parts played by these three types in the formation of the two great star drifts of which the stellar universe is Kapteyn finds that, in passing from the helium type to types I. and II, the approximation to parallelism of the drifts diminishes, the direction of motion gradually changes, and the mean velocity increases slightly. e results of observation, in conjunction with other known facts, lead Prof. Kapteyn to the follow-ing conclusions:

- 1. The stars cannot have been formed from planetary nebulæ.
- The origin of the stars should rather be sought in the spiral nebulæ, our knowledge of which is still so imperfect, and in the irregular nebulæ, such as those of Orion and the Pleiades
- 3. All the known facts indicate that the so-called universal force of gravitation exerts no influence upon the primordial matter from which all stark have been produc
- 4. The stellar system was not originally a single system in which the two known drifts or currents have developed, but the present system is the result of the encounter of two systems which, originally, were entirely independent of each other
- The primordial matter is now more abundant in the drift of less star density and is almost entirely absent from the opposite drift, which is richer in

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The Inventor's Department Simple Patent Law; Patent Office News; Inventions New and Interesting

Stove

Keeping the thermometer at sixty-five By William Atherton Du Puy

R. ALEXANDER GRAHAM BELL D.R. ALEXANDER GRAHAM BELL, other things, is this summer working on a cold air system of making life in city houses in the summer time endurable The results of his investigations have been that he has maintained a temperature of 65 degrees in an improvised study in his Washington home, and has luxuriated in this ideal temperature while Congress, Government officials and others forced to remain over in the heat of the national capital have sweltered.

Dr. Bell's refrigerating system is a modification of the "ice stove" invented some years ago by Willis J. Moore, chief of the Weather Bureau. In Mr. Moore's loe stove the process was reversed and ice was fed instead of coal. A current was passed through it and into the given living rooms of a house. This cold air had a certain effect in lowering temperatures, but it was found that the cold air soon escaped and the original temperatures returned.

Dr. Bell has just returned from a trip around the world. He has spent a year in uninterrupted travel. In many tropic countries where Europeans and Americans dwell he was surprised to note that no effort was made to reduce temper In none of the houses of tropics is the temperature less than the normal shade heat. Dr. Bell held that by taking thought this condition might be improved upon.

He returned to Washington just at the beginning of the summer. The ice stove suggestion, coupled with his observations abroad, and a desire to remain comfortably in Washington for a time to look after his interests, led to cold air experiments. He soon decided that, while the ice stove produced cold air, the ordinary apartment was not fitted for retaining it. It is a well-known fact that cold air is heavier than warn air. Everybody has noticed that when

a window is opened in a room in cold weather, the feet of the occupants soon feel the cold while the room is still The admitted cold air warm higher up. has fallen to the floor.

More exact experiments prove more conclusively the greater weight of cold air. Cold air may be poured into a bucket and be carried about. It is much Being heavier than warm air, however, it has a tendency to spread out as water ould unless restrained. So, when cold air is poured into the ordinary chamber, it flows out through the doors, the win flows or any other leaks that may exist in the given apartment. All houses are built open at the floor level. They will not retain the cold air. An attempt to keep cold air in them is as useless as an attempt to keep water in a bucket

Bell reached. Then the idea occurred to him of finding a receptacle for his cold air On the ground floor of his house is built to hold water. He decided that it would hold cold air.

Dr. Bell discarded the original ice stove and arranged a large ice box of his own design Air pipes lead into this ice box, and lead from it into the bottom of the empty swimming tank. Into this lead pipe is placed an electric fan

Dr. Alexander Graham Bell's Ice the fan is started it draws air through the ice box and conducts it to the botto of the swimming tank. The tank is filled with cold air just as it might be filled with water. To be sure a certain amount of the cold air comes in contact with the warm air at the top and is carried away. But a small current constantly coming in from below replaces it, and the room is kept at the desired tem-

Dr. Bell set the scale of the desirable temperature at 65 degrees. This is re-garded as the ideal degree of heat and cold for the well-being of man. He regulated his fan in such a way that it would keep a sufficient current of cold air con ing into the room to maintain this tem-He moved his easy chair, his study table and his couch into the old swimming tank. There he is spending the hot weeks in ideal comfort, while the President of the United States and those dignitaries who make the laws swelter with the thermometer at 90 and above. Once in three days the ice box requires the current required to keep the small fan going is the sum total of the exof maintaining the cold air plant

ponse of maintaining the cold air plant.
Dr Bell is succeeding in keeping cool in sultry summer weather in Washington, and that weather is as bad as it is easy to find But he holds that he is also establishing a principle upon which may be based a practical plan for refrigerating a portion of any city house. He is not patenting any of his appli ances in this connection. All the world is at liberty to use the scheme of the ice box and the fan and the water tight room for retaining the cold air. In almost any house there is some room that may be adapted to the scheme of containing cold air. The manner of its arrangement and fitting to the purpose may be worked out by the given house bolder. Any man may arrange himself an apartment where he can regulate his climate to suit himself. The expense of this made-to-order climate for an entire summer will be less than a single week's end at a watering resort. Bell believes that the future will wit ness a general application of this meth of overcoming summer heat discomfort through taking thought.

How I Invented the Air Brake By George Westinghous

MY first idea of braking apparatus to be applied to all of the cars of a train came to me in this way: A train upon which I was a passenge Schenectady and Troy in 1866 was delayed a couple of hours due to a collision between two freight trains. The loss of time and the inconvenience arising from it suggested that if the engineers of those trains had had some means of ap-plying brakes to all of the wheels of their trains, the accident in question might have been avoided and the time of my fellow-passengers and myself mighhave been saved.

The first idea which came to my mind which I afterward found had been in the minds of many others, was to con-nect the brake levers of each car to its draft gear, so that an application of the brakes to the locometive, which would cause the cars to close up toward the engine, would thereby apply a braking force through the couplers and levers to the wheels of each our Although the



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that will dried platted in my

Shorty alternate, while I was in stated of an air pump, a main reservoir Chicago, the superincipling of the Chi-linto which air was to be compressed for the Chi-linto which air was to be compressed for Casa. Maringadon. and Quiting Maliread, the locomotive equipment, and four or Mali. A. N. Towna, invited me to impact the cylinders such as were to be put ered an ideal passymmetrically, the Aurora accoming, all so arranged that their operation modeling. I accepted this invitation, as upon a train could be observed. Railsenger (vein, samely, the Ausora scoom-ing, an a arranged that invitation, and while looking over the train, which way officials of the Pennsylvania and way officials of the Pennsylvania and Panhandle railroads were then invited are unrenter of that brake. The Ambler operation. As a result, the superintender, as was explained to me, consisted set of what was then known as the Panorities of a windless on the locomotive which handle Railroad. Mr. W. W. The Panorities of the Panorities of the West State of West State of West West State of West State of West West State of West of a windless on the locomotive which handle Railroad, Mr. W. W. Card, of could be revolved by pressing a grooved fered to put the Steubenville accommowheel against the flange of the driving- dation train at my disposal to enable wheel to wind up a chain which ex-tended beneath the entire train over a series of rollers attached to the brake from the shop and applied to this train, levers of each car and so arranged that which consisted of a locomotive and four the tightaning of the chain caused the cars. Upon its first run after the appraise levers to move and thereby apply paratus was attached to the train, the the brake levers to move and thereby apply paratus was attached to the train, the the tightening of the chain caused the cars. Upon its first run after the apprake levers to move and thereby apply paratus was stated to the train, the the brake shoes to the wheels. I van engineer, Daniel Tate, on emerging tured to say to Mr. Amblet that I had from the tunnel near the Union Station been working upon a brake myself, but in Pittaburg, saw a horse and wagon was immediately informed by him that standing upon the frack. The instantanthere was no use working upon the ous application of the air brakes prebrake problem, because he had devised vented what might have been a serious the only feasible plan, which was fully accident, and the value of this invenprotected by patents. Mr. Ambler's, tion was thus quickly proven and the air opinion and advice, however, proved to brake started upon a most useful and an incentive to a more energetic pur- successful career. suit of the subject.

As an improvement on Mr. Ambier's plan, I considered the use of a long cylinder to be placed under the locomotive, the piston of this cylinder to be be drawn tight by the application of a force which could be more accurately controlled than was possible with the windless arrangement. A short study of this idea showed that it would be im-possible to have a cylinder long enough to operate a chain brake upon more than four or five cars, whereas trains of ten and twelve passenger cars were fre-quently run upon the important rail-

My next thought was the placing of a steam cylinder under each car with a pipe connection extended from the locomotive beneath its tender and under each car, with flexible connections of some sort, not then thought out, so that Although he has farmed much of his life, steam could be transmitted from the lo-comotive through the train pipe to all of the cylinders; but, as in the case of the empt to improve the chain brake, it d but little time with some experimentation to disclose the fact that it be impossible, even in warm weather, to successfully work the brakes cars by means of steam transmitted from the locomotive boiler through pipes to brake cylinders.

Shortly after I had reached this con-clusion, I was induced by a couple of young women, who came into my father's works, to subscribe for a monthanisers worse, to subscribe for a month, evapora for automobile use has been path, by paper, and in a very early number, ented to Ernest Rubes of Brooklyn, No. probably the first one I received, there account of the tunneling of Mont Cenis by machinery driven by compressed air egonveyed through 8,000 compressed air-sparsyed through 5,600 a length of facilible metallic tubing hav-fest of physes, the depth at the time of the transparent of the transparent of the use of the inherent resonant qualities and a compressed air instantly indicated that 'Universor' sound-producing device and brake apparatus of the 'kind gonten: them for operating such device to plated for operation by steam could be operated by means of compressed air on any length of train, and I thereupon began actively to develop drawings of apparatus suitable for the purpose, and in 1867 promptly filed a savest in side in 1887 promptly that a savest in the lamp has electrones neverent water.

The United Mattac Master (Office to protice United Mattac Master (Office to protice United Mattac Master (Office to protice) and the Committee of the Committe

knowledge been put in operation. The apparatus needed for a demonstration was, however, laboriously constructed in a machine shop in Pittsburg, being finally completed in the summer or early autumn of 1868. This apparatus con under the cars, with the necessary pip-

Prior to the construction and practical test of the air brake. I had opportunities while traveling to pres subject to numerous railway officials and to endeavor to secure thei mnected to the chain that it could in the development of the apparatus.

None of those approached appeared to m from the locomotive boiler with have faith in the idea, though I afterward found that the acquaintances made and the many discussions I had had with railway people were of great advantage in the introduction of the air brake upon the railways with which they were connected

(To be continued.)

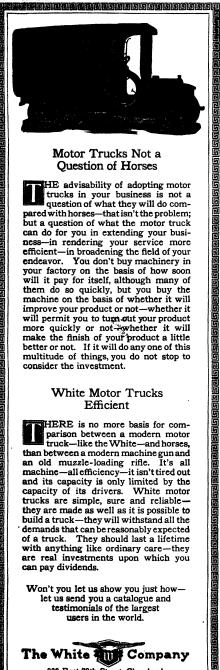
Notes for Inventors

Left-hand Mold Boards for Plows. Patent Office examiner has just returned from a trip to Oklahoma, and remarks on the large number of plows with lefthand mold boards which he saw in use in Southern Ohio, Illinois and Indiana. he is unable to explain why the lefthand mold boards are used.

A New Talking Machine Record.—The Phonosim Syndicate of London is the assignee of a patent, No. 992,169, for a gramophone record and holder in which the record consists solely of an annulus of thin, flexible record receiving mate rial, and this record is combined with a holder which has a backing and means are provided for securing one edge of the record to the holder.

of a flexible metal tube with the bell at one end. In more specifically defining the horn, it is said to be composed of a length of flexible metallic tubing hav-

A New Arc Lamp.—An arc lamp pat-ent, No. 992,479, has been assigned to the General Electric Company, in which the lamp has electrodes between which the arc is formed, and an inclosing globe



Motor Trucks Not a Ouestion of Horses

HE advisability of adopting motor trucks in your business is not a question of what they will do compared with horses—that isn't the problem; but a question of what the motor truck can do for you in extending your business-in rendering your service more efficient-in broadening the field of your endeavor. You don't buy machinery in your factory on the basis of how soon will it pay for itself, although many of them do so quickly, but you buy the machine on the basis of whether it will improve your product or not-whether it will permit you to turn out your product more quickly or not whether it will make the finish of your product a little better or not. If it will do any one of this multitude of things, you do not stop to consider the investment.

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HERE is no more basis for comparison between a modern motor truck-like the White-and horses, than between a modern machine gun and an old muzzle-loading rifle. It's all machine-all efficiency-it isn't tired out and its capacity is only limited by the capacity of its drivers. White motor trucks are simple, sure and reliablethey are made as well as it is possible to build a truck—they will withstand all the demands that can be reasonably expected of a truck. They should last a lifetime with anything like ordinary care—they are real investments upon which you can pay dividends.

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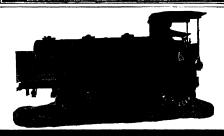
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struction standard in America for seven years has been issued to the Westinghouse
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a folding paper ve a folding paper vessel, No. 393,210, which has a comical-shape portion formats; This receptacle, and folds characted to the receptacle and adapted to be folded to form a handle which shauds at right angles to the walls of the receptacle.

Making a Tree Pull Steelf Up by the Roots.—A stump puller has been pat-ented to Harry Gordon of Boise, Ids., No. 992,419, in which a fulcrum is provided alongside a tree and the trunk of the tree is severed slightly below the fulcrum and is harnessed to the stump so that the tree trunk in falling will tilt on the fulcrum and will operate to pull the stump from the ground.

A New Gathmann Projectile.—On May 16th, 1911, a patent was issued to Emil Gathmann of New York for a projectile whose body portion has a hardened tapered point on which is mounted a tapered soft metal cap, a hollow which cap being mounted on the forward por-tion of the soft metal cap and a reinforce being placed between the wind cap and the soft metal cap.

Necessity the Mother of Invention West with an improvement in farm equipment; but he also evidenced his inventive abilities in other directions. His left leg was paralyzed, requiring him to walk with crutches. He had re-moved the chain and right pedal from an ordinary blovele, leaving the left nedal as a rest for the foot of his bad leg, and he propelled the machine by his right leg, pushing the foot against the ground. Thus he was able to go from place to place with facility. His mode of carrying a watch was entirely original. He wore a chain, but the watch, a big silver affair, was not attached to the chain, but carried in a large buckskin pur with an ordinary metal clasp, and the purse was attached directly to the chain. To see the time, he would take out the purse, open it, remove the watch, and after inspecting it, replace it in the purse, close the purse and put it back in his pocket. The whole performance was carried out with deliberation

For the Hardware Trade,—The rapid and enormous increase in the use of potato and beet-root selcohol as fuel worth utilizing by American manufa turers of articles which could use this material—as, for instance, small cook stoves and portable heating stoves, and fistirons (or sad-irons, an' it please you better) heated by a small internal alco hol burner. There are hundreds of thou sands of these made annually; and their sands of these made annuarry; ann the convenience in very small households renders their introduction merely a question of the price of the so-called "detion of the price of the so-called "de natured" or undrinkable alcohol. There is a society in Germany compos tillers and manufacturers of alcoholburning devices, which holds permanent exhibitions of such apparatus, offers prises for the encouragement of the industry, etc.

assignee of a Havre (France) inventor for an electrically propelled train of a number of vehicles with an engine on each vehicle and generators driven spectively by the engines and propelling supplied respectively from the generators upon the same vehicles as are propelled thereby, and means are provided for con trolling the operation of the engines and of the motors from a controlling point on the train.

A New Edison Patent, -- A patent, No A New Edison Patent, — A patent, No. 988,394, was formed May 33rd, 1911, to Thomas A. Edison; for a device for feeding pulvevulent material, which included a number of parallel server conveyers arranged in different beginning the section and soluted to course they mentally be need.



ings in ear kind of wood and
eyes a smooth, round note,
flads from the best steel,
flads from the best steel,
flads from the best steel,
formed, tricked and tempered. One he staryeared from
the inside without a Sic Friens, Rim., Sol Kina, So.
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Embehar, Ph.D. New York: D.
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she work, and its value to railway men and to students on scarcely be overestimated. Railway Promission in Section 19 william Z. Ripley, Ph.D., Professor of Economics, Harward University, New York: (Inn. The first part of the volume is deviced to registrate of Price," and Ide M. Tarbellis, "Simpley of the Section 19 will be supported to the Section 19 william of the Section 19 will be supported to the St. Louis Starbess Men's League and the Dawson and the Innex Men's League and the But Innex Men's League and the Dawson and the Innex Men's League and the Dawson and the Innex Men's League and Lea sense than prince the present of the present of the process of the process of the present of the government regulation is given a thoughtful disconsion, and the great underlying princi-ples of constitutional law as defined by the Euleral Course of the Course of the Course Section Course of the Course of the Course are spose into to some length, and their adapt-shilty or non-adaptability to American condi-tions in poland out. It is Frot. Higher's con-clusion that our transportation grabem is the blat in the world; but, as he says, that is no reason why it may not be improved upon as

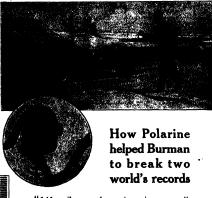
Mess.

SULPHYPIT MANAGEMENT AND MALEDADE.

By Louis D. Brandels. Web, Terk:
Who Imputedring Megadels, 1911.

Fro. 72 D.

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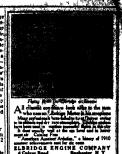
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The editor of the Raticesy Age Generite gives the non technical reader a view of the manager's problems in militorial organization that the work. The ristensents come sharp and clear as the crack of a gun on a fresty more large we are at once initiated into the mysicise of construction—the backgravitre start the field staff diplemetry overse the right of statices to be surmounted before the mer lies is finished and turned over to the operating organization a diagram of this operating organization and dispensation of the operating organization in its broadest, simplest from will above the outline of an hour glass of the surmounted before who is turn appoint a president. The presidents powers are directed and diffused through vice-presidents, the general manager and superintendents, until the gradie and control the lower must be the dispensation of the operation of the complex than the above superficial statesoem would imply it is in presenting these complexities and showing the ways in which they are met and handred that Mr Morris distinctive of converging the howwholes to other in simple and attractive language. Plentital dags me clearly of converging the howwholes to other in simple and attractive language. Plentital dags me clearly of converging the howwholes to other in simple and attractive language benefits and proposed clear of development are reviewed as affected by combinations traffic resources, short on ditions and popular demand. Nothing between the road and its patrona Tender concessful rainty administration is, they will be more sympathetic and leitent toward hard by preventional selection of the control of the open of the ope by prev ntable abortcomings. At the same time their new knowledge will enable them to discriminate between the faults inherent in all numan systems ad the deliberate im-positions and extortons f a monopolisti-body toward them. positions and extort ons f a monopolistic body toward those whom it was created to serve

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The Interstate Commerce Law (Continued from page 551.)

practical questions have arisen and been presented to the commission by both carriers and shippers without waiting for their presentation in a formal proceeding. In this practice there has grown up what may be not improperly termed a code of rules, regulations and conference rulings, which is of great practical value and assistance to the commission, the carriers and the shippers adilks, and which has been manifestly of fective in the elimination of vagueness and ambiguity in tarifix and the erroneous and unlawful application of their provisions in many ways formerly prac-

To the extent that a better enforcement of the law has cut out rebates and unlawful concessions in other forms its result has been doubly beneficial it has promoted equality among shippers and conserved the carriers' earnings to an important extent.

The full situaturement of the beneficial interests of the law depends in western

The full attainment of the benedeent purposes of this law deepends in great measure upon the do-operation of every carrier and shipper with the commission, and it is a cause for patriotic congratulation and satisfaction that the viciousness of oftenses in violation of the break limitions of the law is being more and more realised as its just purposes are counting to be batter understood, and that it is no longer lightly regarded and that it is no longer lightly regarded character and with supunity solicit unlawful favors and advantages from the carrier or that the latter may with impunity grant them. Both must realise that when they obtain most by violations of law they pay more for it than it is worth.

Relations of the Railroads to the Public

(Continued from page \$87.)

benefit by railroad extension in that the increasing population following in its wake will muitiply domestic markets, and domestic are preferable to foreign markets. The population of this country increased nearly 18,000,000 in the decade from 1900 to 1910, and in that increase the railroads were perhaps the most important factor. They made remote lands accessible, the disposition of their products practicable, and essabled the distribution among their inhabitants of the products of our factories

This addition to our population during ten years is simout as great as the population of Mexico and the five Central American States combined, and its consuming capacity is far greater. If we had acquired the exclusive trade of Mexico and these five Central American States, or the entire twade of Chile, Peru, Boilvia, Venesuela, Ecuador, Uruguay, and Paraguay, the combined population of which is not quite 18,000,000, we should not have obtained the same advance in our commerce as has been provided by the increase in our own popularity of the contract o

We should reflect that by opening upnew and improving our existing railroads we can provide for the needs of a population twice as great as we now have and our country would still be aparsely settled in comparison with that of other prominent nations. For example, the German Empire has in Europe a population of 55,065,000 in an area of 2000 country of 50,000 country of the country of 50,000 country of the provider and the state of the country of the over area is more than fourteen times as great.

We not only need new railroads, but every railroad in the United States is in constant need of extensions and tim-provements. The domands of an increasing traffic are forcing betterments of all lrinds, its equipment, in track, in stations and warehouses, botter facilities for everything that a railroad does. Every railroad manager has plans for extension and improvement that are postponed from year to pear. It will not do for the people of this country in measuring the property of the railroads do say that, a curious rails of groft less than he yielded from the country of the country in the country of the people of the country in the country of the people of the

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on practically overcome. Cheaply mounted on ar-tice engine. SEND FOR CATALGOUS. THE TI-SE, THIS IS OUR FIFTY-NINTH VEAR.

The undertaking owes the likeopiles, sectively to the hold, prosprawing policy at Mr. Charles M. Hayes, the president of the Grand Truth Railway against my conceived the idea during the short periods be wan in charge of the Union Pariods for Mr. Harriman. When the salesmy was submitted to the Canadian Government for approval and support it was warmly supported, and tangethe financial assistance was promised. The Government, because the salesmy was submitted to the Canadian Government, because the salesmy of the control of the Canadian Government, because the salesmy of the salesmy of

expensive to build, the Government is contributing to the cost to the extent of 25 per cost. When the scheme was sanctioned it was decided that construction should be carried out upon a high standard, in e-construction to the scheme was sent to the scheme with the scheme to the scheme to the scheme to come, thus avoiding that realignment and reconstruction which is so severe a burden upon American railways to-day. For this reason it was stipulated that the ruling grade should not exceed fourtenths of 1 per cent per mile against east and west bound traffic, and that curves should not be sharper than five degrees. Timber treatles also were to be omitted, unless it was intended that such should be afterward filled in to form a stable embanisment. The Government section is 1,804.84 miles in length, and extends from Montes in the side of the scheme to the scheme

such anould be arterward filed in to form a stable embalment. The Government section is 1,804.84 miles in length, and extends from Moniton in New Brunswick, which is the Abel of the Abel

and northwesterly direction through the heart of the province of Quebec, until it crosses the 46th parallel, keeping on the northers atops of the "Divide" all the way to Winnipse. The construction of the line through Quebec and Ontario has bristled with difficulties, the greater part of which, however, were in regard to the sending forward of supplies and material. The road, 100 feet in width, has been oleared the whole distance between Winnipse and Quebec, come 1,344.38 miles, and the grading is well advanced toward completion.

miles, and the grading is well advanced toward completion.
Westward of Winnipeg the Grand Trunk Pacific has completed and inaugurated its service upon the 793 miles, and line to Bamonton. This section is laid over the rolling prairie, with the result that grades and curves are of the easiest description.

that grades and curves are on two consume, description.

The prairie section extends for 13st miles went of Education to Wolf Creek, a tributary of the MadLeed River. This point is the edited commencement of the mountain division, set the section to the coast is called, insumned as it has to negotiate the decities and the coastal continuation of the Coastale continuation of the Cascades. At Wolf Creek the track is, at an elevation of \$2,00 feet above the sect level, and yet the highest point yealout it work in any extra highest point yealout it work in the continuation of the Cascades. At Wolf Creek the track is at an elevation of \$2,00 feet above the sect level, and yet the highest point yealout it would be a section of the coastal continuation of the Cascades. At Wolf Creek, and the coastal continuation of the grades represent the section of the section of the section of the grades represent the section of the section



incorporate -





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The BRISTOL COMPANY. WATERSTRY CONT.



age of 18 feet to the mile, which a

age to the less to the little, which ascent its almest impercaptible.

Though the railway cannot offer such examples of spectacular engineering as the Reckies in Montana and Colorado. examples of spectacular engineering as the Beetics in Montans, and Oolorado, yet the greatest achievament lies in the arodance of these vary obstaices, so as to provide an aimost level route, with no ediffer grades and sharper curves than are to be met on the open prairie. To railway operation this is of fracreaching value. For instance, a locomotive of would hault only perfectly level track 3,088 sons. On a 1 per cent grade, however, it could handle only 300 tons; but out a four-tenths of 1 per cent grade, such as is provided on the new transcontinen-

out a four-tenths of 1 per cent grade, such as a provided on the new transcontinental line, its hauling capacity would be almost double—1,596.

The western terminus of the line is at Prince Rupert, where there is a manuficant natural harbor varying from three-quarters to one and a half miles in width by ten miles in longth, which warring from 180 to 600 feet in depth, with an unchatracted entrance three-quarters of a mile wide, is considered the finest harbor north of San Fran

cisco.
That this railway is destined to exercise a far-reaching influence upon the movement of traffic across Canada, owing and envexture and movement of traffic across Canada, owing to its easy grades and curvature and closer proximity to the Orient, is admitted on all sides. Moreover, its physical conditions, combined with substantial conditions, combined with substantial interest of the control of the committee of the committee of the committee of the control of the cont learnitory, rich in mineral, timber, and possessing excellent stretches of agricultural land, is being opened up, and the route cannot fall to have considerable infinence upon our trade with Alsaka, to which it will be the obvious highroud, linking it directly with our manufacturing and industrial centers, and involving a sea passage to Skagway of only about 500 miles.

The World's Greatest Railway Terminal

Terminal

(Continued from page 504.)

is estimated that 70,000 outbound passengers can pass through the terminating mean carrying power of any passenger station existing today. Yet the station, extending today of the station, extended at a maximum of 500 trains an hour; is due to the introduction of the loop system, both for express and suburban service. Instead of trains coming in, discharging passengers and backing out, they will continue on, when wasty, around a loop underneath the southerly from of the station, and then run over to the yard at one side of the station yard, where they will be cleaned and made ready for the sext trip. No longer will the trains be run out through the Park Ayenuse tunnel to Mott Haven for cleaning and making up, and the Sout tracks through the tunnel will be left entired by two for the service of the Sout racks through the tunnel will be left entired by ree for the service of the left entirely free for the service of the

left entirely tree for the service of the immensing and outgoing traffic.

Not only has electricity readered possible this underground and entirely-inclessed station, but it has cut out a large amount of switching and has been called into service in the installation of an all-cleerite signal system, which is one of the latest and most perfect to be devised. As interesting detail of the signal system, which is one of the latest and most perfect to be devised. As interesting detail of the signal system, which is one of the latest and most perfect to be devised. As interesting detail of the signal system which is considered as the signal system of the signal system of the signal toward clear the up the main line—an arrangement which will save minutes of time over the old

We doubt if, anywhere on sarth, there san he found such a busy center of sity and, railway traffic as that represented by the intersection of Forty-second Street and Park Avanue, where the entrance to the Gread Central station is located. Park seems arriving in New Tork, will find themselves in immediate boards with half, a dozen or more separate these of plantages of the second state of the second stat We doubt if anywhere on earth, there

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level are the surface cars of several of the main lines of travel morth and south lavel are the surface cars of several of the main lines of travel neath and south through the sevanes and cast and west they the structs. Above these is a branch of the elevated system which puts the passenger in touch with the east side elevated reads throughout the length of Manhattan and the Bropur. Immediately below the street is the Interhorough subway. Below that will be tip, new subway connecting with the Huddon and Manhattan tubes to which passengers mill be the street of the str

statistics which cannot fail to be of in-terest. The total area of the old terminal was 23 acres; that of the new will be 70 acres. The old terminal had a capacity of 386 cars, the capacity of the new will be 1,146 cars. The station building proper will be 900 feet long on street level, 300 beev ride and 100 feet high level, 300 beev ride and 100 feet high long, 480 feet wide and 48 feet desp. The main concurse will be 130 feet wide and 100 feet high. Bighty-dre thousand tons of steel will be used in the con-struction of the new terminal.

Hygroscopes

(Com)

(Consteased From page 282)
precious stones, and sometimes to giorify
pieces of piain giase so as to make them
appear like genn. This foll consists of
very thin silver or copper, colored on
one side with a kind of varish. I find
that designed to imitate the supphire
does very well. If is of a fine blue color.
Three small silps are out off by scissors
(not a knife or the varaished part will
peel off), these strips are then twisted
round a wire until they resemble ringlets or shavings, as shown in the sketch
round a wire until they resemble ringlets or shavings, as shown in the sketch
round a wire and the strip of the color
and a needle set in the theseboard and
running up the hollow resenter of each
serves to keep it roughtly-its place, and
to prevent breaking by accident. Three
little paper flags are attached as slown,
having on one side the letters FRY,
and on the other WET. It will be
found that these flags turn round instantly when the air becomes damper
or driet—indeed they will turn on the
approach of a moist hand, or when they
are ever so lightly breathed upon and
the support of the strip of the support of the strip
swithdrawn. A wire stratched access
the frame prevents the flags from going
beyond the position where the letters are
most visible. The spiral slips are fixed
by secotine at the top to small pege. precious stones, and sometimes to glorify most visible. The spiral slips are fixed by seccotine at the top to small pegs, which can be turned round for adjust-

which can be turned found for adjustment when required."

A very popular kind of hygroscope—
and to have been introduced by Wood
to the property of the property of the following the second of the se ment when required."

The Railroad Man and His Watch

I'm may be news to many that the a watch of the railroad man is as necessary in modern railroading as the albrake. Without accurate time keeping there would probably be more accidents than if there were no sat-prakes. The train dispatcher efarts a train at a certrain dispatcher starts a train at a cer-tain time; he haits fat corrain stations at certain times; he sidefracks it for a period of varying length; the watch of the conductor on the sidefrached train must agree with the watch of the con-ductor on the supress its which he had to give way; each matter along IUST PUBLI

A New and Authoritation Best

MONOPLANES and BIPLANES

CONSTRUCTION OF STATISH

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ing one of the guester goals of week greater of the guester goals of development of the present goals of development of the present continues and the present continues to the present continues the present continues of the present continues to the

while to aviators themselves. There is, consequently, a wide demand for a practical hook on the subject—hook treating of the theory only in its direct relation to actual saroplane designed to prevailing precises in the construction of the survey of the control of the control

Mr. Loming, who has come in intimate contact with many of the most need arisen and constructions and who has made a prefound study of the subject for year, is unusually well informed, and is widely recognized as an expert in this line. In clear and definite vitys, and in remarkably through and well—arranged manner has presented the subject of artistics. The scientific exactness of the valuable ably therough and womber of aviation.
The scientific exactions of the valuable he has presented the subject of a trial the heart of the scientific exactions of the valuable data and reference, as well as at he high character of the insumerable fillustrations and diagrams, needes this work only the best and the most useful, practical and the most useful, practical and to be the scientific properties on accordance to the literature on accordance.

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and are a your dealer, and grice
and dealer's name—we will this proposit,
attaches immediately, without threading.
Prior all eat, 8. Highgover rifles, shy call, 97.

MAXIM BILENCER, Heriford, Conn.
Ipoly they now see rife is juid sale a finish the sillness.



the road checks the time of every train that stops or flee past.

In order that there may be agreement among all these ratiroad men there must obviously be not only timepieces, but accurate timepieces. There must also be not only timepieces, and if they may be not only timepieces, and if they agree with one accurate, and if they may be not only timepieces. There may be not only timepieces to the not only timepieces to the not only timepieces. agree with some standard. The railroad man is therefore compelled to buy not simply an ordinary watch of reisonable value, but a particularly good watch, a value, but a particularly good watch, a considerable of the sound of the properties of the process of the

worth the average of \$25 aplees (a low estimate) are used on other roads throughout the country, it is evident that the value must run up into hundreds of thousands of dollars.

* In order that the watch may be kept up to a regular standard, it must be inapected regularly. There is not only a general time inspector or most railroads, but a staff of local inspectors who are placed along the road at convenient points, and to whom the men may resort when they wish to compare their time with the standard time at that place. Once every two weeks the railroad man when they wish to compare their time with the standard time at that place. Once every two weeks the railroad man submits his watch to age an inspector (usually a Jeweler or watch and the probasion). The inspector gives his exposed in the probasion of the inspector gives his exposed. If it needs cleaning, he says so and does it; if it is fast or slow be regulates it, and not until it is running with audicient accuracy is it allowed to except from his care. A watch's record is kept as if it were a their. So far as repairing goes, the railroad man is under no compassion. He need not hand over no compassion. He need not hand over or impactor, for repair, but bethnaker, or impactor, for repair, but bethnaker, or impactor, for repair, but bethnaker, it to any watchnaker in whom he has condience. It must, however, be submitted to the inspector before it can be used in actual service.

That no favortism is shown in the matter of watches is evident in the fact that no less than eight different manufacturers supply railroad watches.

Plants Breaking up an Island.

Plants Hreaking up an Island.
THE layman wouls exercely associate
A great strength with so delicate and
fragile a thing as maidenhair feen, set if
its roots have not sufficient room they will
break the pot in which the plant grows.
Blades of grass will force the curbatones
between which they spring up out of
libeir place, and in a single night a
crop of small mularbroome has been known
to lift a large stone. Indeed, plants are
on record as having broken the hardest.

The island of Aldabra, to the north west of Madagascar, is becoming smaller through the action of the mangroves that row along the foot of the cliffs. grow along the foot of the cliffs. They est their way into the rock in all directions, and into the gaps thus formed the waves force their way. In time they will probably reduce the island to pieces.

What Becomes of the Old Parchments?

Parchments To LD parchments of LD parchments of all descriptions have invested a process for removing the fath, and eventually the cleaned parchments in many cases come book, as "fine Clippings remaining when the gloves are made are not wasted. Mixed with velture and bits of leather they are basied down for "size." The coarse dealing with odds and each of seal of the coarse with the coarse with

the road checks the time of every train This is Interior Protection. the Kind that Safeguards Life and Contents

Tenant, owner, builder and architect shoe Tenant, owner, builder and archibet; should first know what constitutes absolute freproof protection rather than to learn afterwards that their confidence had been misplaced; that, however perfect and freproof the exturior walls, they only form a fine for the destruction of the inflammable interior and contents of the building.

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A complete train made up of these "Dreadnaughts" not only provides the safest means of transportation by rail, but the easiest as to personal comfort.

It isn't such a far cry in matter of time between the little wooden coach which trailed behind "John Bull" and the massive all-steel car of to-day, but there are few stronger proofs of the wonderful advance in transportation facilities.

The Pennsylvania Railroad has always been the leader in these lines of progress.

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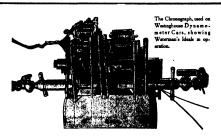
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Acconstation

Accidents with acroplance, quite a few of which are fatal, continue to occur almost delivered at the stehans. There allows the accident with the panel of the gates of detail to the gates of detail to the gates of detail to the stehans. There are almost the contract of the stehans of the steh which are itsia, columns to estimate the Maily. Office of the Maily of Mail

Flying at Rate of 185 Miles per Hour.—A rather incredible report has been received, stating that aviator Vedrines, while flying from Paria to Rome, covered the distance between Dijon and Macon the distance between Dijon and Macon— (1½ mitse—n 30 minutes. This is at the rate of 155 miles per hour, and, if correct, means that Vedrines was flying in a wind of 85 to 90 miles per hour. When one considers that Pierre Marie and Lleut. Dupuis were upset and killed when setempting a flight in a 48-mile wind on May 18th, the performance of wind on May 16th, the performance of Vedrines, as cabled to America, is truly astonishing. He was so badly tossed about the truly which prevailed at the 3,000-toot level that he descended, and his monoplane was smashed in alighting. He was therefore obliged to abandon the Paris-Rome-Turin race. Two other avis-Paris-Rome-Turin race. Two other avia-tors—Frey, on a Morane, and Vidart, on a Deperdussin monoplane—succeeded in reaching Rome last week, so that there are four to finish the race on June 10th.

A College Balloon Race.—The first col-lege balloon race to be held in this coun-try was started from North Adams, Mass, on June 3rd, under good weather conditions. Williams, Dartmouth, and the University of Pennsylvania com-peted with the balloons "Stevens No. 27." "Boston," and the "Philadelphia II," re-spectively. The "Boston" landed at West, Pelham, Mass., 41 miles from North Adams; the "Stevens No. 27." at Pazton, Mass., 66 miles from the starting point, after 4 hours and 53 minutes in the sir, and the "Philadelphia II," at West Pes-body, Mass., 15 miles sway, after a trifle and the "Philadelphia II." at West Pes-body, Mass., 115 miles away, after a trifle over 7 hours in the air. This balloon was pliced by Arbur F. Atherbolt, an ex-perienced balloonist of Philadelphia, who had George A. Richardson as his sid They landed in the woods during a heavy tunder storm at 10:30 P. M. The great-tunder storm at 20:30 P. M. The great-est heavy and the storm at 10:30 P. M. The great-tive was 120 over a boot Prichburg. The doubt atmulate interest in aeronautica among college men. among college men.

Our Backwardness in Aeronautica.— The launching of the largest dirigible in the world in England last month has called attention to the backward state of the world in England last month has called attention to the backward state of our country in seronautics. With the small appropriation for scroplanes are proposed to the first proportion of the service of the service of heavier-than-sir machines even, let alone diling our needs as regarded lighter-than-sir craft. England is making a great effort to eath up to France, German, and Russis, especially in the dirigible balloon class. In comparison to her new signatic dirigible we have only the small one supplied by Capt. Baldwin several years ago. When our two or three acroplanes are compared with the fifty to sixty machines of all types owned by the French government, we are scarcely worth mentioning. It is interesting to note that while France and Russian are experimenting so actively with aero-planes and dirigibles, our give remember has just opened a balloon school at Fort Omaha, Nob., where there is a special has just opened a balloon school at Fort tr Omaha, Neb, where there is a special is hydrogen-generating plant for making so gas by electropics. On May 24th Capt, ro Chandler, accompanied by four of the as eitzene students, made an assension and wi landed in Iowa. The balloon was ro equipped with a wireless telegraph out. Of all and receded meanings from Fout for

Two Dreadnessits for Chili.—According to cable dispatches British bullders have obtained the contracts for two 28. have obtained the contracts for two 38, 600-ton battleships for Chili to be named the "Libertad" and "Constitution." It wis extend that each ship will carry tweets 13.5-inch guna—though low they are to do it on the given displacement is to us, we must confess, a mystery.

The Big Slide at Panama.—Although the slides at Panama are formidable they the sides at Pennem are formidable they will not delay the ultimate completion of the whole work. The largest willed lies on the west bank of the Cubebra out, and from it during the past, year over 2,000,000 cubic yards of material were 2,000,000 cubic yards more will have a constant of the complete o

billity alope is reached.

The Krupp Aerial Terpedo.—The Krupp aerial torpedo, which is self-propelling, can be fred from on aeroplane without disturbing the aeroplane's stability. A torpedo carrying six pounds of explosives has covered a range of \$5,000 yards. The torpedo is driven by the gases of a slow-burning powder rear. The gas tubes are set at an engle which gives a spin to the torpedo.

Reduction-mean Tarkings.—The types.

which gives a spin to the torpodo. Reduction-gear Turbins.—The two colliers, the "Neptune" and the "Jupiter," each to be driven by turbine engines, which are being built for the United States navy, will carry between turbine and propellers two different forms of reduction-gear. The "Neptune" will have the Wastingtonus mechanical will have the Wastingtonus mechanical tric speed-reduction drive. In the territor speed-reduction drive, in the territor speed-reduction drive motors on the current will in turn drive motors on the current will in turn drive motors on the

The New Armor Plate.—The Simpson armor plate, of which we hear so much to-day, is broadly similar to the old comioday, is broadly similar to the old com-pound armor plate, which was formed by wieling a hard steel face upon a soft steel or from backing. The armor was imperfect, the face breaking away from the backing when struck by a pro-jectile. Simpson secures a bond by weld-ing a thin plate of copper in between the two layers of steel. A 25 per cent substitute is claimed over Krupp armor, a substitute in claimed over Krupp armor, and be welded on by this process. Tunnel, 1,00 Feet Below the Hudson River.—The Catskill water supply will be carried below the Hudson at Storm

River.—The Catakill water supply will be carried below the Hudson at Storm King in a tunnel bored through solid rock at a depth of 1,160 feet below the surface of the river. The vertical tun-nels on each shore have been sunk to the 1,100-fock depth, and the boring of the horizontal tunnel to connect them is the horizontal tunnel to connect them is in progress. To determine the character of the rock, inclined hore holes were driven from each side to a depth of 900 feet, and below them other bore holes were driven to a depth of 1,500 feet below the river surface.

below the river surface.

Accidents an Railroada.—The Quarterly
Accident Bulletin just published by the
Interatate Commerce Commission for the
months of October, November and December, 1910, howe that there were \$48 persons killed and \$7,79 injured in train accidents. Accidents of other kinds bring
the total number of casualties net including "industrial accidents" up to
2,889 killed and 19,927 injured. Of this
number there was a total of \$35 cm;
ployees killed and 19,928 injured. There
is a total number of 60 killed and 87
injured in coupling and uncoupling ears
and engines. Accidents reported by elseinjured in coupling and uncoupling cars and engines. Accidents reported by electric lines and on which interstake traffic is carried show that there were 115 persons killed and 1,681 injured on selectric roads. Of the total number of "industrial accidents," those scutstand by employees where no moving engine or call was just before the coupling and the coupling of the coupling of

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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION AT

NUMBER CIV.]

NEW YORK, JUNE 24, 1911

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Bertalling of the Ac

in the foreground is shown the temperary 190-foot extension of the play which is built of open piling with free passageway for the tidal flow. In the same Spain with the "Olympic" is the "Platend," 350 feet in length. In the adjoining basin is the 70-foot "Oceanic." The "Olympic" is 882½ feet long.

SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, JUNE 24, 1911

patrot to Almar & Co. Incomoration. Charles Allen Mu.: Preside Leaders & Courses & Beach, Sorper and Transment all to del Bregaman. New York. Entered at the Post Office of New York N. Y. and Second Class Matter Copyright 1911 by Mirror & Co. Inc.

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The Scientific American Publications

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Munn & Co., Inc., 361 Broadway, New York The latter is allowed glad to receive for examination illustrated articles on subsects of fundy interest. If the photographs are dury, the article shared and the fast official and the fast official and the contributions will receive second attention. Accepted articles will be prod for at regard spot of these.

The purpose of this journal is to record accurately n simple terms, the world's progress in scientific Inochedge and industrial achievement present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fuscination of science

The Gould-Scientific American Prize

THE conditions under which the prize of \$15,000 which Mr. Edwin Gould promised, through the columns of the Scientific Addition, to award "for the most perfect and practicable heaver-than-air flying machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate produces and procedure and motors and propellers), so connected that any power plant may be operated independently, or that they may be used together. If sad the date June 1st, 1911, as the final day upon which entries were to be received, and July 1st, 1911, and following days as the dates upon which the contexts themselve were to take where

sches were to take place.

The many letters which we received, expressing approval of the motive that prompted Mr. Gould approx to the motive that prompted Jr. Jona to offer the prize, led us to hope that a considerably greater number of machines would be submitted than are actually forthcoming. By June 1st five designers had entered their machines, but of these, designers had entered their machines, but of these, as subsequent correspondence revealed, only offectuared himself ready to submit a machine one declared himself ready to submit a machine to the testing committee on July 8th, 1911. Since the conditions state that "at feast two machines must be entered in the contest or the prize will not be entered in the contest or the prize will not be entered in the contest or the prize will not be entered in the contest or the prize will not be entered in the contest of these facts. Mr. Gould has generously consented to repeat his offer for another year, after which it will be definitely withdrawn. The conditions will remain exactly as they are, with the exception that one or two will be added which will not in any way affect the plans of designers who may have intended to complete but were prevented from doing so because of the limitations of time.

One year means much in aviation progress. In country a plant for the manufacture of at least one well-known French biplane. That other French manufacturers will follow suit seems almost certain. Within the coming year, therefore, entrants for the Gould prize will be in a better position to carry out their ideas than now. Until recently there were only two well established types of American fly mg machines, and two factories in which the buildmg of the flying machine proceeded with anything like regularity and system. Most of these establishments hunt their output entirely to machines of their own design. Because there have been no plants conown design. Because there have been no plants con-ducted by men of experience to whom entrants for the Gould SCIANTINE AVERIEAN PIRE could not be awarded on the coming July 4th. Manufac-turing facilities play a large part in contests such as these; at least we judge so from the fact that despite the express limitation of the competition to Americans, we received communications from for-eign aviators who desired to enter and who could turn to at least a dozen factories in France alone for assistance in constructing a machine which would fulfill the requirements. With the establishfor assistance in constructing a macmine wince would fulfill the requirements. With the establish-ment in this country of branches of French aeroplane factories by men of large experience the prospects for the Gould-Scientific America, prize from July 4th. 1911, to July 4th, 1912, are brighter than

The rules governing the competition for the prise will be published from time to time in the columns of the Scientific america, with the additional conditions previously referred to.

The Preservation of Niagara Falls

THE widespread awakening of the public mind to the importance of rendering the environment of human life as beautiful and cleating as possible, consistently with the daily routine of our busy modern life, is one of the happy omens of the time. Evidences of this awakening are many and various. It is visible in our domestic architecture, and in the interior furnishings of our arcinecture, and in the interior runnings of our homes. Its recognition has led to the demand that our public buildings shall be monumental, not merely as to their mere bulk, but in the just balance and proportion of their measses, and in the appropriate character of the details. Our best architects are striving, with a scal which is worthy of a better success, to lend some touch of beauty to that modern monstrosity, the sky-scraper building. Most promis-ing, also, is that recognition of the inherent monotony and ugliness of many of our modern cities, which is expressed in the new movement in the direction of civic government.

Further evidence is shown in the growing deter-mination of the American people to preserve intact-the more notable of the objects of grandeur and beauty, with which the hand of Nature has so liberenriched the United States. The legislation which has thrown its protection around the Yellow-stone Park, the Yosemite Valley, the groves of majestic trees in California, and the various national reserves of the country, has rendered, both to the people of to-day, and to all posterity, a service which will be acknowledged with prowing emphasis as the years go by. Never, we believe, has ice which will be earhowiedged with prowing em-phasis as the years go by. Never, we believe, has preservative legislation of this character received auch widespread approval as that which award the majestic Falls at Nisgara, already sadly defaced, from further spoliation by hydraulic power plants. The interest in the Falls is more than national—it is worldwide; and the traveler from other countries, be he European or Asiatic, considers that his itine ary is scarcely complete unless it has included Ningara. Hence the announcement that the integ-rity of the Falls had been forever insured by an international treaty between Canada and the United States, was received with all but universal approval. There are other great waterfalls in existence, it is true, notably the majestic drop of the Zambesi River at Victoria Falls; but they are more or less inac-cessible—altogether so, in fact, to the traveler whose

cessible—altogether so, in fact, to the travelex whose purce is limited; whereas Niagara, by vittue of its necessibility, is open to the world. It is that very magnitude of the Falls, which lends to them their majestic beauty, that has brought about the threat of their destruction. Those thousands of tons of water, falling ceaselessly through a height of 180 feet, awaited only the development of the water turbine, the electric generator, and the copper transmission line, to render the commercial exploitation of the Falls an exceedingly attractive promosition.

proposition.

Now the Scientific American would be the last to depreciate the technical skill with which the various power companies, through their engineers, have planned and built the huge power houses which are at present in operation. These, together, with the various electro-chemical and other industries which

at present in operation. These, together with the various electro-chemical and other indicatives while, have a prung up at Nisgara, are among the most civilitable works of their kind. From these to interprition in the column of this journal, as our scale well know. But, at the same time, the have clamped here alive to the fact that the water drawn from the upper river detracted from the beauty of the Palls, and that the various buildings, admirable as it the architecture of many of them, have been a discordant feature in those landscape surroundings to which the scenic beauties of the Nisgara River, Palls, and Gorge are largely due.

It is natural that the power companies, should wish to take additional water from the Fallis it is also readily understood that creatin interests in this city of Nisgara and other contiguous localities may be interested in the further extension of manufacturing interests that draw their power from the sompanies. In our correspondence columns will, its found a letter of protest, from a citizen of Nisgara Isls, which will be read with interest. The question, however, is one which must be considered from the Falls have been damaged, as stated by the personal desiration of the Editor. Further depletions of this well near the unwatering of station of shallow will near the unwatering of station of station of the content of the latter.

further red

The Unification of S

HE division of the cutire real into a number of separate dome HE division of the cities reading of situation into a number of separate discussive assume the better result, not see much of any inheritations with the phenomens that comes within one was, as of certain poculiarities of our senses. The same sum's ray which, entering the eye, causes a visual causation, will, if received upon a sensitive position of the skin, give rise to a feeling of heat. It is true that there are "heat ray" incapable of affecting the eye; but a study of the phenomenous shows that the seruing separation of this best resiliation from the limitations of our organ of sight. In spatio of fact, there is a perfectly centinuous and gradual transition from the rays of short wave longitude perceived by the eye, to the longer waveve longitude of safe, there is a perfectly centinuous and gradual transition from the rays of short wave longitude we become cognitant only by our least each. More does the matter end there. We am follow up batcher this continuous sequence of waves, to a point where cause more there is a discontinuity, not in the range of phenomeno observed, but in the methods available for their observation. In this way the identity of light, radian theat, and electro-wagnetic er of separate a available: for their observation. In this way the identity of light, radiant heat, and electro-magnetic radiation is established, and the barriers dividing three fields of physical scence fall to the ground. If we turn from the consideration of radiant heat

If we turn from the consideration of radiant base to the phenomenon presented by the intrinsic heat of matter, we find a similar state of affairs pretailing. That the "heat" of a body, as manifered to our sense of touch by its temperature, consists in the rapid motion of its ultimate particles, themselves too small to be directly observed by sur senses, was surmised as early as 1890 by Francis Bacon. The final substantiation of this point of, view may be said to have been furnished only in quite recent times by the work of Zaigmondy, and his followers upon ultra-microscopic particles and the Badwinian movement. Thus the phenomenon of heat to brought within the pale of mechanics. Sound, for which also we possess a special sense, and which thus+downs the subject of a separate branch of physics, has, of course, long been interpreted as a mechanical effect.

bysics, itas, of course, long been interpreted as a mechanical effect.

The whole range of "physical" phenomena is therefore guthered under two main divisions—the mechanics of material systems on the one hand, and electro-magnetism on the other. And is the process of unification to stop there? Or are these two last divisions also to be merged into one? There is much in modern electrical theory which seems to point in the latter direction. Strange to say, however, it is not electricity, the more intangible, the more material theory which seems to point in the latter direction. Strange to say, however, it is not electricity, the more intangible, the more material theory which seems to point in the latter direction. Strange to say, however, it is not electricity, the more intangible, the more intangible, the more intendible in the same of the electromagnetic kind, and all matter is cleetricity. As yet these questions are undesided.

If we look beyond the bounds of "physical" selected in any other parts of the electromagnetic kind, and all matter is electricity. As yet these questions are undesided.

Selemee in the narrower aerone, we see signs of the

If we look beyond the bounds of prayaces, science in the narrower armse, we see signs of the same unifying tendency. It is true that chemistry unifying tendency. It is true that chemistry tation purely in terms of other physical concepts. But much has been done in developing the genund was that border land where the two selences meet. The more sampling sames as replaced but with

on that border land where the two accessors mean. The more sanguine among us perhaps look, with, some confidence to the coming of the day when the same confidence to the coming of the day when the same confidence to the coming of the day when the same confidence to the conting of unitar fact for the bridighted sciences. Many think that there are elements involved here, which are not reducible the nursely physical entities. Such a question only the future call decide. In the meanwhile was make welcome the movement among certain halomata. Inture call decide. In the mean-while we must welcome the movement among certain biologists, which makes for exact quantitative methods, and fers stress on the investigation of those aspects of life phenomena, which are beyond question of hip-phenomena, which are beyond question of physical-character, and as such are governed by physical-law. From such works as Le Danbe's recent hoof, "La stabilité de la vie," handl agrings; housely, vie science which bears the same gelation to biology; significant of the science which bears the same gelation to biology; significant of the science. Whethor science will be the match be found to fuse into one whole in the science will be the science will be a supported by the science will be scienced by the scien matry be found to fuse into one space; of cirided into two or, more clousing, the lower terms, it is at present impact Quite uncestakeable, however, such a manufacture of the property which assistant that it is not present that it is a factor of the large part from a factor of the large part of the large

Sir Hiram Maxim

The Autobiography of a Veteran Inventor

fact that the following elected of his coreer rising, by Nimeelf will lend particular interest biggraphy of Sir Hiram—Ev.]

MIRAM MAXIM is of Puritan parentage, is born to Sangerville, Me., February 5th, 1840. res educated at the common schools, and at the of 18 commenced to serve an apprenticeship as enaker at 'Abbott, Me., working in the ner time and going to school in the winter, up the age of 20. Here he made a tricycle with bloyc tals of the present type. These are believed to ch the hub was suspended by snokes in tension

During the civil war he was employed at the se worked first as a machinist, then as a brass der, and finally as a draughteman. During the st year of the war he left Fitch

urk and went to Boston, where tered the amploy of Oliver Drake as a draughtsman. ke was a very clever philo orkical instrument maker, and

While at Boston, Maxim in rented many different forms of gas machines. From Boston he went to New York, where he as employed as a draughtsman it the Novelty Iron Works at At that time this firm had in hand the building of the Pacific Mail steamers.

It had been said by those who mded to know that there was no possible way of making chine for carburcting air for illuminating purposes, which would produce a mixture of a uniform density, but Sir Hiram discovered no less than three separate systems of accomplish ing this. In one system, the regulating device was operated by the expansion of the air during the carbureting step. was carbureted too much, the expansion produced a preat opened a valve and allowed nump into the pipe leading to the regulating device was opd by the specific gravity the sea. For this purpose a cyler was suspended on a scale beam in the gas. If the gas was too rich, the cylinder was buoyed up and by this movement was opened shunted the air around the car-A very large machine of this type was made at the Novelty Iron Works for the Americus Club in Connecticut, This was followed by another system in which the gaso line was first converted into a

wapor by best under a pressure of 28 pounds to sheep square inch.
The vapor in cacaping was made to force the necessary sir into a gas holder. This machine made gas of an absolutely gas holder. This machine made gas of an absolutely gas holder. uniform density and of the density required, and common into very general use. One was placed in the Mew York past office, another in the Woman's Home. All of A. T. Stewart's mills were equipped

of York. All of A. T. Stewart's mile were equipped in such machines, and one with a capacity of 10,000 neer was installed at Seretons Springs, where it that the Grand Union Hotel, the St. James Hotel, fish Windows, Fishell.

abor one, Shr Tilmas took up the subject of electric visits many inventions, and took out many mile. The makes all the appearation and put up the description of consistency of the springs of Capacity and Capac

hydro-carbon gases. He discovered a new process of making phosphoric anhydride, reducing the cost from five dollars to fifty cents per pound. He made the first regulator for keeping the pressure constant in an electric lighting system quite independently of the number of lights on the circuit. This apparatus was exhibited in Paris in 1881, and Sir Hiram was made a Chevalier of the Legion of Honor.

In 1883 he left France and went to London and commenced work on an automatic gun. Up to that time no one had ever attempted to make an automatic gun. The first gun made was operated by backward movement of the cartridge in the harrel at the instant of firing, a system which is largely used in automatic pistols at the present day. But this system would not work with the long bottle-neck military cartridge, so the next gun made worked by the ing the gun to visitors. This invention put Sir Hiram in the first rank of scientific men. It was thought It was thought that as he had solved such a difficult problem that he might solve others

At that time the British government was about to pay a very large sum of money for the secret of the German slow burning brown powder. Many of the scientific men of London had analyzed the German powder and found that it contained no new man power and round that is contained to de-element, they could make an exact initiation of it, but the German powder produced low pres-sures and high velocities and the English mita-tion produced high pressures and low velocities Everyone by a tempted to find out the server by chemical means, but Sir Hiram attacked it with his microscope and found that the German powder was slow burning because the crystals of niter, although

small, were many hundreds of times greater than in the Eng-lish powder The mystery was solved and the money saved

Sir Hiram followed this up by making a hundred different kinds of powder in a single day. all of different degrees of slo burning. The sulphur and charcoal were put in the mill and thoroughly ground and incorporated, the niter was then added and specimens taken out as the process advanced. first specimens were very slow and the last extremely violent.

This led to a great number of other experiments with pow-

At the beginning of 1885 many officials expres opinion that the Whitehead torpedo could not be relied upon in a heavy see and Sir Hiram was requested to design a very large gun for throwing aerial through the air stead of propelling them through the water On May 30th, 1885, he patented the gun desired and proceeded to make one The projectile was pro-vided with a delayed action fuse working on the same plan as the best fuses of to-day. large experiments with this led to the manufacture of the first cordite, and curiously enough this cordite had the ex act diameter and appearance of the British cordite that was made some years later ('hemically, it differed but slightly from the ballistite of Nobel

In the early spring of 1888 Sir Hiram was requested by some high British officials to turn his attention to the manu facture of a smokeless powder. and experiments were conducted through the summer which led to patents being taken Novem ber 8th, 1889 This was followed by many other patents on various kinds of powder. (See Eng January 27th, 1911) amokelesa Engineering, Among these patents is one for a mix

ture of nitro-glycerine, gun-cotton and oil The ap plication for a patent covering this was filed fourte days ahead of another application for practically the e thing handed in by Prof Abel and Prof. Dewar. In the end, however, it was found that the original by Sir Hiram in the apparatus patented in 1887 was a practical smokeless powder. It was a powder made by this process that was exhibited at Springfield, Mass, the first smokeless powder ever wn in the United States

When the French were boasting of a very remarkexplosive that they had discovered and which could be shot through armor plate without exploding from the shock, Sir, Hiram set to work and very discovered that this much boasted explosive was a odified form of picric acid. He made it in England end it is practically the same as what is known as

SIR BIRAN MAXIM

recoil of the barrel and breech block, that is, when the gun was fired it was allowed to recoil one inch, and the energy thus developed performed all the functions of bringing the cartridges into position, trans ferring them from the belt into the barrel, firing them, extracting the empty cases, expelling th cocking the hammer and bringing the new cartridge

When it was enhaunced in the newspapers that an American eaginest having a little workshop in Hatton Garden, London, had made a machine gun that would acquaity load and fire itself, at the rate of 600 rounds in a minute, from energy derived from the burning powder, the public were incredulous; it was altegether too good to be true. But the little gun was very much in evidence and everyone came to see it, from the Phine of Wales down. Over 200,000 rounds of fully loaded satisfary cartifices were need in show-Recall Control of the control of the

(Continued on page 451.)

Our National Earthquake Recorder

Feeling the Earth's Pulse

By Emma M. V. Triepel, B.S.

THERE is a widespread impression that earthquakes grow more numerous as our earth ages.
Certainly we hear of them more frequently than our
predecessors did. But this is mainly because of our predecessors did. But this is mainly because to increased facilities for transmitting the tidings of such occurrences. They have been studied and theorized upon from the earliest times of which we have any knowledge, but the ancients had such immature concepts of the constitution and environment of the earth that they accomplished little of permanent value. However, they invented some crude in-struments which showed the passing of earthquakes and the direction in which they traveled. Such a contrivance was in existence in China as early as 650 B. C.

During recent years of scientific activity the phenomena have received their share of artention. All the causes of sarrhquakes have not been determined, but it is agreed that contraction of the earth account and consequent cracking is one of the most potent in producing them, In regard to the recording and measuring of seismic disturbances, great prog-ress has been made. Each of the more important countries has now its system of seismographs, set up for the purpose

of facilitating study along that line
In the United States this work is
conducted by the Weather Bureau
under the direct supervision of Charles F. Marvin, Professor of Meteorology, to whom is due the credit for developing the selemograph in his office up to its present state of completeness so that it includes all the more important features evolved hitherto by himself and other investigators, improved by him to the highest degree of efficacy

In order to attain accuracy in a seismograph several requirements must be satisfied. The whole instrument must be extremely sensitive, yet it must be so fashioned that it can withstand the most severe earthquake without de-rangement of its functions. It must as fan as possible be free from such disturbing influences as fluctuations of temperature and surface tilting, it must be easy to manipulate, to adjust and to maintain, and its method of registra tion must be as nearly infallible as it can be made.

The essential features of a seismo graph are three in number, viz: I. The steady mass. II The trans-mitting apparatus. III The recording

The steady mass is the basis of whole instrument, its function being simply to remain at rest throughout all shocks, whatever their intensity. In Prof Marvin's seismograph the steady mass weighs 1,300 pounds and is in the form of an inverted pendulum as shown in Fig 1 The length of its vertical support is 17 feet. The whole is inclosed within a solid pier of masonry. A post hole extends several feet below the pier and in this a piece of fron pipe. at the bottom, is set up vertically upon a good strong footing of concrete. The strut for the steady mass terminates at the end in a type of universal pivot. The steady mass and strut with its suspension can be inserted and removed from the pier without de-rangement of the suspension. It is rendered astatic by the reaction of a cylindrical steel spring rod, which is fixed at the center of percussion of the whole mass. It is necessary that its re-action upon the suspended mass shall coincide as closely as possible with the force of gravity so as to neutralize it

peculiar fitting of the spring aid in the peculiar nting of the spring and in the elimination of friction. At the lower end the spring is fitted on a slight taper and is driven into a massive metal plug; at the top it is attached by

means of a screw clamp to a flat, tempered steel disk, which in turn is securely clamped around the periphery to the top of the pier. The greatest care is taken to center the steady mass vertically above its pivots. Both the spring rod and the plate must be of the best spring-tempered steel to secure thorough elasticity, and both must be adjusted as perfectly as

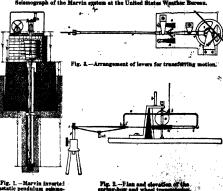
The method of building the mountings of the steady mass within instead of upon the pier secures solidity and invariability to a high degree besides eliminating unequal changes of temperature in dif-ferent parts of the apparatus, which may cause shift-

ings of the zero position in exposed selsmographs.

II. Several requirements must be satisfied in the transmitting apparatus:

1. A maximum motion

aph of the Marvin system at the United States Weath



PERLING THE BARTH'S PULLE

must be allowed for. 2. The linear o motion must be taken off and records 3. Friction must be reduced to a minim motion lost in transmission must be as little as sible. 6. The proportion between the motion ceived and that transmitted must be unifor ever the extent of motion or its range. 5. One ditions of simplicity, accessibility, adjustability and convenience of manipulation and maintenance scured as nearly as practicable.

Prof. Marvin has developed the apring-bow method of magnification transmission, the plan and elevation of which is seen in Fig. 2. The topmost extremity of the steady mass terminates in an adjustable pin as.

the steady mass terminates in an aquistable pur at Two adjustable hardened steal cups, showing at a dis-inserted at right angles to each other, was about the other. S is a piece of steal wise 0.044 inch in diameter, restling is a and bent in the form shown. The The books A, A', are formed of fine wire-coiled and slipped over S. W is a fine skeleton wheel mounted on a fre moving, pivot pointed axis. The rim of this wheel is provided with three grooves marked in units of 0,001 of an At one side of the wheel a h is made through the rim at the hottom of each groove. One end of a piece of ordinary silk sewing thread is passed through each of the boles in the out side grooves, the free ends being afterward knotted together. A loop of the thread is pulled through the hole in the bottom of the central groove, leaving the knot on the inside of the rim. The thread is attached to the spring bow by means of the hooks at A" and h". The spring bow is suspended in a free moving fashion by means of a thread. The small weight wt serves to keep the point of the spring 8 in the

> This system takes off the motion very smoothly, obviating shake, lost motion and friction. The arrangement of the double thread in the three grooves secures a perfect balance of internal forces. The action of the spring bow takes up symmetrically any slight variations of the thread from moisture or other causes; the tension is equalized by the threads being free to slip over the hooks h" and h" when parallel to each other. The wheel W. if one inch in diameter, provides for 3.14 inches of motion and more than one turn of the wheel can be made. Through this arrangement one com

> ponent of the motion is transformed into approximately one turn of the

To transmit this motion with the necessary magnification to the sheet a system of levers shown in Fig. 3 is employed. The distinguishing features of this system are the means by which the motions of the levers stop hen they reach a certain extrem when they reach a certain extreme po-sition. But the motion of the wheel W and its odinection with the steady mass are not limited by the levers. For this purpose devices similar to those employed in the lever escape ment of all ordinary watches are used.

A pin P on the wheel W engages a forked opening in the lever. I neath the fork of the lever a sms enters the notch or opening in the flat

When the motion of the wheel W carries the pin out of the fork in the lever, the pin below the fork has the wise passed out of the notch to the rim, and the lever is prevented by the run, and the lever is prevented from from returning until the movement of the wheel adopting re-engagement of the pla? and the part of the lever appeared by provided with a patiented pla. P. which in their departments of the provided with a patiented pla. P. which in their departments.

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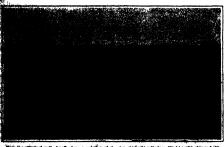
Uncovering the "Maine"

How the Work at Havana is Progressing

Will playe ginzy be a touch of the moried in dispepad interest which has been aroused spit stikings to recover the "Mathe" from "within fire to many years have given it be public interest in securiting more than states; it is expansible to respectful and loss, of the treasmotions dramatic and po-dispace, which most over attach to the pitl of 1888 Whether the ship went down to

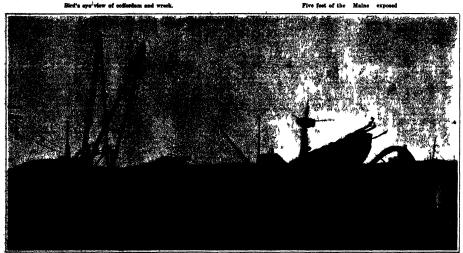
been known to occur especially since the introduction of smokeless powder The case of the French battle-ship Jena" is still fresh in our minds Improved powders possessing satisfactory chemical stability and refrigeration of the magazines to preserve the pow der at a safe temperature have practically eliminated this risk from the modern warship It will be best for all concerned and will certainly cast no reflection upon the ill-fated ship or its officers and crew if it

All that now remains to be done in exposing the Ma ne is to pump the cofferdam dry and this work is now in progress. At the time the accompanying photographs were taken the water level had been re-du ed some five feet or more or sufficiently to expose the quar er deck which thus for the first time comes the quar er deck which thus for the first time comes to view after being for thirteen years below the sur-face. The portions of the wreck that have been ex-posed are about in the condition that was to be ex-



n consisting of circular statisficillé cylinden. Alled in with clay and alle. Bird's eye view of coffeedam and wreck





View inside cofferdam after water was lewered five feet. The confused wreckage shows the center of the explosion. The curved member to the right has boat crane. The mass to the left is the steel dack (ander side) which was thrown upward and backward by the blast of the explosion.

UNCOVERING THE MAINE

at verting place by nocident or dealgn, the has that the wreek of the "Maine was the s and enout potent cause of that upheaval of talon wifich resulted in the Humini-Ameri

median the car

shall be found that the condition of the unwatered wreck shows the force of the explosion to have been from within

The plan adopted by the army engine The plan adopted by the army engineers for examining the hull of the vessel was to build around the wresh a massive, watertight wall pump out the water leaving the bettom mud exposed and then dredge away the mud from around the hull leaving the little is considius for examination. The cofferdam wall, which is clittled in plan consists of a series of ovijinging 40 to 56 test in diameter which wave foreast by divining down to firm bottom circular collidates continued of introductions stated plate, and were cornease by arriving down to have bottom circuits of civilizing the confidence of interlocking steel piles, each cylinder being thirty driving the piling piece by place until this drivel was complete. To make the joints between the grinders watertight, a segmental wall of giffing and just down between such part. After the week the grinders were filled with the week that and until the week that the piles are all until the week that the piles are all until the piles are all the piles

pected being heavily coated with barnacles and marine growth

The many fears which have been expressed that the cofferdam wall would be unable to withstand the in Ward pressure of the water have thus far proved to be groundless since at the present writing the work is both watertight and stable. The Maine lies how ever in 37 feet of water and when this has been removed the full test will come However the pumping is being done gradually and as the water inside is lowered the behavior of the cofferdam is being carefully watched for any indication of weakness or seri ous seepage Should the wall show evidence of yielding it will be possible to strengthen it by dumping rock back-filling against its interior wall and if need be by running heavy timber struts between the cofferdam and the wreck although much reliance can not, of course be placed upon the resisting strength of the badly shattered hull

John D. Hooker and the One Hundred inch Reflector

A Business Man Who Took an Interest in Astronomy

By Mary Proctor

T is a subject for comment that the largest teleopes throughout the world have been constructed by the liberality of individuals, and perhaps a majority of the greatest discoveries, as well in a as in the other sciences, have been made by those working in a private capacity, with their own instruments and in their own observatories, and having no ments and in their own conservatories, and naving so connection with any public institution. In January, 1610, Galileo amazed the world by his discovery of the four moons of Jupiter, with the aid of a small lens endowed with a magnifying power of only 33 diameters. Since then, more powerful instruments have heen constructed, culminating in the Lick equatorial of 36 inches, the Yerkes equatorial of 40 inches, the 60-inch reflector, and the Snow horizontal reflector of

24 Inches, both on Mount Wilson.

The summit of Mount Wilson is nearly six thousand feet above the ocean, located but a short distance from Los Angeles, the metropolitan city of southern Call fornia, in a district exempt from harricanes, with an atmosphere free from disturbances, and affording advantages unequaled by any other known place. For this reason it was selected a few years ago by the egie Institution as a suitable site for the erection of the 60-inch redegior already referred to, and the results obtained have proved the wisdom of this choice. Wonders of the starry regions have been disclosed by means of the photographs taken with this reflector, far excelling the powers of definition hitherto obtained by the largest refractors. For the reflecting telescope is superior to refractors in photo

graphing the nebulæ, etc.

During the last decade of the marvelous growth of Los Angeles, one of her most energetic public-spirited and prosperous citizens has been John Daggett Hooker. A man of unassuming personality, identified with all good works for the advancement of the ma-terial interests of southern California and, from a modest beginning achieving a distinguished position in the mercantile world, he has been a leader among working for higher intellectual advanmore particularly in the way of affording facilities for scientific pursuits. In early youth he became in-terested in astronomy, dating from his first view of a total eclipse of the moon seen by him when a boy eight years of age. Later on he came across a copy of Burritt's Star Atlas, with its fascinating combinations of stars interwoven with mythological figures, and poring over these by day, and tracing out the constellations by night, he gradually attained a general knowledge of their position and outlines. Then he attended a course of lectures on astronomy given by the writer's father, the late Richard A. Proctor, and from that time his enthusiasm was fully aroused. He started the foundation of an astronomical library, and also purchased a Byrne five-inch objective. He fitted out the entire upper story of his spacious Colonial residence on Adams Stréet, Los Angeles, as an observatory and workroom for the unrestricted use and occupation of the Astronomical Section of the South ern California Academy of Sciences, of which he has been a member almost from the date of its organization

He has designed what he terms an electro-trans-

parency, illuminated with sixteen electric lights, by means of which he obtains a brilliant display of en-larged views of photographs taken with the 60-inch reflector at Mount Wilson. Becoming pro reflector at Meunt Wisson. Becoming prerousary im-pressed with the work accomplished by this 'eisesop, he became imbused with the desire to furnish the means for a reflector which would emulate the per-formances of the 60-incl. If a 60-incl reflector will accomplish more than has been done by the Crossty reflector at the Lick Observatory on Mount Hamilton, what will a 100-inch mirror disclose? The country, tion of such an instrument would be the work of a comparatively short time, and enthused with the idea, Mr. Hooker entered into communication with the Car-negle Institution at Washington. He offered to give the sum of fifty thousand dollars for the manufa-ture of a 100-inch reflector. The proposition was a cepted, and there was no delay in prosecuting the

work. The order for the casting of the glass disk was given in September, 1906, to the Frenck Flato Glass Companies at St. Gobsin, France, and during the year between the spring of 1907 and June, 1906, alt or eight castings were made. In order that there height be no delay in the grinding, polishing and Eguring the disk after its arrival, Mr. Hooker constructed at Pasadena, in the winter of 1907, a building which he supplied with all necessary appliances. The main room is 24 feet square and 20 feet high, and opens supplied with all nece into a long testing hall.
"The walls of this room are very heavy, m

brick laid in cement, and covered with a roof of re-inferced concrete. This portion of the building, which is separated from the other part by iron doors, may therefore be regarded as fire and earthquake proof a consideration of no small importance in view of the nature of the work to be done within its walls. heavy steel beam, supported over the doorway, carries a traveling crame, by means of which the mirror disk and heavy parts of the grinding machine, one of which weighs 3.5 tons, can be brought into the room and handled when necessary during the progress of the work. The testing hall, 100 feet long and 10 feet wide, will permit the mirror to be tested from the of curvature or with parallel light. On one side of the testing hall are rooms for the grinding and polishing tools, and for the apparatus, required to maintain the polishing room at a uniform temperaere is also a large fireproof vault, for the storage of astronomical photographs. On the other side of the hall a series of computing offices is pro-vided, affording with the rooms already available in the adjoining building, suitable accommodations for a large staff of computers." (Annual Report, 1907, of Prof. G. E. Hale, Director of the Mount Wilson Solar the Carnegie Institution of Wash-

In June, 1908, information was received at Los Anspeles from the glass companies at St. Gobbin Chat the casting of a perfect disk 102 inches in diameter, 23%, inches thick, and weighing 4½ tons had been success-fully accomplished on December 3nd, 1098, in his iron case, it reached the end of its long journey, and was deposited in the Hooker building at Pasadena,

the upon being unpacked it, will be the lens was bulgerfact side (the field the lens was bulgerfact side) (the field the lens of the order.

Fred. G. W. Hildshey of the lens an attempt is at present puring re-jected mirror first sent up to the pu-perfection, and the writer saw the p actually under way during her year

actually under way during her systems, in haboratory at Pankaton. It is estimated by hence of the meeting dame and self-signous to several hundred followsside, of accesses of the original gift of dry thousand outsit demands by the Rockets, that it is better to corry the perject brough to utilize the to corry the perject brough to utilize the problemory. In the laterator of the pressed as part of the control of the pressed of inducedup, in 1806, from Williams Ray, We be summed at Bount William Collibration, wonderful powers of definition intigat he. wonderful powers of dennium their fullest extent as far an photos Milky Way, clusters and nebular to complete the complete to the complete the complete to the work was autocessfully accomplished by Barnard of Yerkes Observatory, and the being compiled in book form by the Ca tution. The scientific world is indebted; this case as in the instance of the 160-lap to the generosity of Mr. John D. Booker wi the accomplishment of the work possible.

The following tribute of appreciation was written by Sth by Prof. G. W. Ritchey, of Mount Wiles

"In the death of Mr. John D. Hecker of Los Augi "In the death of Mr. John D. Handare of Leak algorithm not only the Menut. Winken Observatory, but the entire inclentific world loses one of its meat generous it is quite certain that had it not been for Mr. Hooker's enthuntamn and generous, the 100-inch Hooker's enthuntamn and generous, the 100-inch Hooker's enthuntamn and generating the second of unprecedented size, which is now under way in the observatory shops, would not have been

"In his love for science, Mr. Hooker had the vi of a prophet as well as the keen pragreat man of business. He appreciated the vast ald and advantage which could be brought to his beloved and anyantage want outsit so receipt to me secrets ascience of astronomy by the use of photography, and he determined to supply that aid by providing for the construction of the largest and most perfect photographic telescope which the present development of glass making, of optical work, and of mechanical ngineering would allow.
"Mr. Hooker watched with the keenest inter-

process of the work upon this telescope—the grind and polishing of the 100-inch glass, and the design and polishing of the 100-inch gram, and the besigning of the great telescope mounting and its greatestage that the production of the great telescope mounting and its greatestage of us who have associated with him is his work that of us who have associated with him is his work that see outle not have tived to see the conspiction, and its see the incomparable selectful photography which it will make possible. But the work will go (ph) and bear his name."

Identification of Dve Woods

THE Forest Service has just issued a very practical publication dealing with the structural characterists of true fustic wood (Chlorophora tinctoria, Gand, and its substitutes and subtreamts in the use of making dues. The circular considers only true fustic and three of its most common substitutes, leav-ing untogeted the groups of other woods employed in making dye extracts. The study on the identification of other important dye woods by George B. Sudworth, Dendrologist, and C. D. Mell, Assistant Dendrologist, will be continued and the results published in a series of papers illustrating the need of closer inspe dye woods of commerce. Great pains and no little ability have been used in presenting the facts of this new and technical subject in such language as will be understood by all intelligent savmen. will be understood by all intelligent saymen. Where technicalities are used definitions and lithurations are given or the context explained so that the aver-age person will readily understand them. The authors give a key which will emphie the "man in the street" to identify the woods comments, substituted for fusich. The illustrations of magnitud transverse sections of

the wood show the characters which will help the er to recognize the woods considered. of forestry, as well as timber merchants, will not only find this circular very instructive, but also illustra tive of a new and interesting type of government publications. The circular begins with a brief government eral consideration of the properties and uses of the woods together with a list of their common trade names. The remaining space is devoted to a detailed names. The remaining space is devoted to a sequential description of the minute structural elements in the wood of true fusite. This paper is the first contribute tion to the literature dealing with the subject of substituting inferior woods for a standard kind, and will may be cited as an excellent memograph of a standard kind, and with the contribution of the co

New Associans Speed Records in Pro Na official tyrout of his 40 horsepower and templated Bifriot monoplans on June 1944, where you being solecule as one 27 the Transite Bennatt cup these in Smallette as June 1, the Bennatt cup these in Smallette as June 1, the Bennatt cup these in Smallette as June 1, the latest few 10 themselves. Events a few 10 themselves are the smallette and the sma hour, 18 minutes and 36 seconds, corresponding to an average speed of 71.16 miles an hour. Four days later N. Nicupart, in a similar test, overred 445 hisman 90.9 miles—at the rate of 80.15 miles an hour, as ing to the cable dispatches. Both tests many over a 8.1-mile chroular course.

By covering 10 kilometers in 48,58 (1914 with hour), Lobiano fersiend by 3 miles and 158, (1914 with hour), Lobiano fersiend by 3 miles and 158, Milest (1747 miles) to one hour, the America second 158, Milest (1747 miles) to one hour, the America second to the hour the first second to the hour that it reported to the high the first second to the hour than 15 miles and 15 miles an

grout with the Bibrick range is a pract of 924 wiles an hour.

J. Armstrong Desiral may represent faterantonal range with Ministry.

T. Weymann with a Ministry.

Longer Piers for Giant Steamships

Arrival of the 882 1/2-foot "Olympic" at New York

FATIVAL CIT.

The agreed of the disposes that can be presented of the White Star Line at the port of New Case assignment the measuring for the stage of the White Star Line at the port of New Case assignment the measuring for the time of the court of th

The pler head lines of the ports of the United Biggs are determined by the Board of Bugineers of the same, who have charge of the nation's interest in the gary, who have charge of the nation's interest in all members absolute the physical side of our rivers, higher, channels, waterwars, etc. It is their duty the see that these national proparties are not futured in the encreachment of private interests, whether conference personal, and to preven the actuation of pième unedny into rivers and channels, or the ob-mitteling at the latter by bridges and other struc-tives. The army engineers have been exceedingly righted in their guardinguish, and when it was pro-mond to actual the New York lifers 100 feet to ac-commendua to tonner about the the research day, they semmedate the longer ships of the present day, they straincoairy opposed the movement on the ground that it would constitute an obstruction to navigation. reducing the navigable width of the North River by 100 feet, and to that extent increasing the conges-tion in an already rather crowded fairway.

when he are already return rows trained to a Various instruction interests in New York, including the interests proposed in the statements companies and several commercial bodies, urged upon the government the weadon of making the desired plar expension, pointing out that

the Hussan River had considerably the greatest width of channel between pier head lines of any of the leading ports of the world, the clear width being for the Husbon River at New York 2,750 feet; River Merger at Livespool, 2,000 feet; River Thames at London, 1,800 feet, and for the River Elbe, at Ham

By way of compromise the Secretary of War gave on for the lengthening of the piers by 100 feet. The important proviso was made, however, that the extension must be of temporary character, and built of such open construction that the river current could flow freely through it. Moreover, the permit was made merely for the extension of the pier and not for the pier shed. The structure was

pier and not for the pier aned. The structure was to be removed within a period of eighteen months. On the front page of this issue will be found a bird's eye riew of the White Star pier as lengthened under this permit. The extension consists of cluters of piles capped and sway-braced, with planked runways for the use of the dock crew in handling the mooring and warping cables. It will be noticed that even with this 100-toot extension the pier overlaps the stern of the "Olympic" only by a few feet; sufficient, however, to give her ample protection against collision from passing vessels.

By way of illustrating the remarkable growth of

the coean ship, our artist has shown two other large liners, one of which, the "Oceanic," at the date of her appearance, excited even more attention on ac-Lying abreast of the "Olympic" is the "Finland," of the old American Line, herself a vessel of no mean proportions. She is 580 feet long, 60 feet broad, and 42 feet in moided depth. In the adjoining hasin, on the opposite side of the pier shed, is shown that vessel, the "Oceanic," the first ship to exramous vessel, the "Oceanic," the first supplied ex-ceed a total length of 700 feet, and the first vessel to surpass in length the "Great Eastern." The "Oceanic" is 704 feet long on deck and 88 feet

. In a succeeding issue we shall give further par-

ficient here to give the leading particulars.
Length over all 882 feet 9 inch-
Length between perpendiculars 850 feet
Breadth, extreme 92 feet 6 inch
Depth, molded, keel to top of
beams, bridge deck 73 feet 6 inch
Total height from keel to navigat-
ing bridge, about 104 feet
Gross tonnage 45,000 tons
Load draft 34 feet 6 inch
Indicated horse-power of recipro
cating engines 30,000
Shaft horse-power of turbine en-
gine
Speed 21 knots
Displacement 30,000 tons

ticulars and illustrations of the "Olympic." It is suf-

It takes but a glance at our front page engraving to show that not merely in the matter of length of pier, but also in that of width of basins, the steamship companies, if they continue to increase the size of ocean liners, will be confronted with a perplexing problem. If the "Titanic," a sister ship to the "Olympic," were moored in the same basin, say, in the place of the "Finland," it would be difficult, if not impossible, to coal the ships at the same time Certainly a string of coal barges could not lie alonggide the two ships simultaneously, nor could empty barges be towed out and full barges brought in It is evident, therefore, that a point has been Feached, at least in the history of the port of New the whole question of dock accommodation will have to be taken up anew, and a system of new docks laid out on a scale which will provide adequately for the inevitable growth of ocean liners of the largest size. A thorough study of this subject has been made by the present Dock Commissioner, Calvin and in the mid-month magazine number of the Scientific American, which will be published on July 18th, there will appear an article from his pen, dealing with this important question.

Correspondence

The Preservation of Niagara Palls

To the Editor of the SCIENTIFIC AMERICAN: At the head of the editorial columns of your pub-ileaton I note that it is declared that "The purpose journal is to record accurately and in terms the world's progress in scientific knewledge and industrial achievement." Immediately following this declared purpose, in your issue of May 27th, you publish an editorial entitled "Niagara Falla Again

The writer has resided a lifetime in proximity to the great Falls of Niagara, has witnessed the electrical power development from the beginning, is familiar every detail of if, and confidently asserts that the diversion of the waters of the Niagara River for development purposes has made absolutely no lible difference in the flow of the river. The only difference that has been seen in the river has been caused by the changes in the direction of the been caused by the changes in the direction of seried, by so jame for a few hours in the winter, and ty high said low winter conditions that are periodical said are constant to all labels and creams, Bonetimes than Lake Change washed in banks and constitute them. The contribute the said washing the conditions there are made from the beautiful of my many financial of my many facilities and that has been a second of the said to be said to water on the American side and 36,000 cubic feet per second of water on the Canadian side. This pro-vision was in accordance with the recommendation of the International Waterways Commission, which thoroughly investigated the subject. The present diversion on the American side of the river is 15,600 cubic feet per second of water, so that there is still way of 4,400 cubic feet per second of under the limitations of the treaty. Before the present permits were granted under the Burton law that went inso effect June 29th, 1906, William H. Taft, then Secretary of War, came to Niagara Falls and then Segretary of War, came to Niagara Falls and, gave a hearing to all parties interested. In granting the power permits, Secretary Taft promulgated a lengthy opinion, in which he said: "The International Waferways Commission, a body

appointed under a statute of the United States to fer with a similar body appointed under a statite of Canada, to make recommendations with reference to the central and government of the waters of Great Lakes and the valley of the St. Lawrence, have looked into the question of the amount of water which could be withdrawn on the American and the dian side of the Niagara River without substan tial injury to the cataract as one of the great natural beauties of the world, and after a most careful examneasures of the world, and after a most careful exam-nation that have reported, recognizing fully the neces-lify at preserving intact the scenic grandour of the March Tails, that it would be wise to restrict intervalue is \$4500 cities feet pre-second on the Amer-tical Computer of the March Sandian side to 28,000 cubic feet a month.

construction of the familian shie to 80,000 cubes assembly. Lates the Berlish-American treaty provided for a disconsist of 50,000 cube fast per second of uniter up the Berlish-American de 30,000 cube fast per second of uniter up the Berlish of the St. 100 cube fast per second of uniter up the Berlish of the St. 100 cube fast per second of uniter fast fast, 100 cube fast per second of uniter fast the Berlind of uniter fast to 100 cube fast per second of uniter fast to fine the second of uniter fast to the second of the 100 cube fast per second to the second of the second

amount diverted from the American side, shall not interfere with the navigable capacity of said river or its integrity and proper volume as a boundary stream, or the scenic grandeur of Niagara Falls This peculiarity in the act is significant of the tentative opinion of Congress that 15,600 cubic feet of water might be diverted on the American side and 160,000 electrical horse-power might be transmitted from Canadian side without substantial diminution of the scenic grandeur of the Falls." And then Secretary Taft gave his decision that "Acting, however, upon the same evidence which Congress had, and upon the additional statement made to me at the hearing by Dr. John M. Clark, State Geologist of New York, who seems to have been one of those engaged from eginning in the whole movement for the proervation of Nisgara, and who has given close scientific attention to the matter, I have reached the conclusion that with a diversion of 15,600 cubic feet on the American side and the transmission of 160,000 power from the Canadian side, the scenic grandeur of the Falls will not be affected substantially or per-

ceptibly to the eye."

That is the diversion that is taking place to-day. It was the judgment of the International Waterways Commission and the men who framed the Britis American treaty that an even greater diversion would not be injurious. It was the opinion of the Congress of the United States and Secretary Taft that the present diversion would not be injurious. A test made by engineers of the United States Lake Survey Corps proved that the diversion is not percept and we who see Niagara River daily say that no effect on its flow is seen as the result of power development. There is now being developed from the Falls of Niagara \$50,000 electrical horse-power. Their total power proauguou electrical norse-power. Their total power pro-ducing capacity is estimated at from 5,000,000 to 7,000,000 horse. Do you think the cataracts as a spectacle are seriously threatment? C. T. Williams. Niagara Falls. N. Y. City Industrial Agent.

Liquid Blag from Producers .

AT the experiment station of the United States been made with a gas producer using coke as fuel, with which limetone has been mixed in varying proin the purpose being to flux the sab and form a liquid size, thus avoiding clinker and ash troubles, and consequent shut-downs.

Dynamite as a Railroad Builder

High Explosives as One of the Principal Agents in the Building and Reconstruction of Our Resilronds

By Willard Young

N O'T many people besides railroad engineers and dynamitie makers know that the improvement in blasting explosives during the past two decades has seen one of the principal factors in making possible the fast and contortable trains now running on almost every railroad. Yat this is an indisputable fact; for the straightening of the railroads which has been carried on so industriously for several years has lessened the time for trains running at the same speed as formerly, as well as the distance between stations. Again, the straightening, combined with leveling, has made it possible to run trains with safety at a gravily increased speed. Heavier and more substantial cars can be used, and the decrease in curves and gravily increased speed. Heavier and more substantial cars can be used, and the decrease in curves and grades reduces the wear and strain so much on rolling stock that it does not need to be repaired or replaced so often The money thus saved can be used for more comfortable and luxurious equipment, and for running trains more frequently. No matter how well constructed the road bed or how perfectly built hear, the surge and jolt when rounding short curves, the long, joiling drag up heavy grades and the rush down with intermittent application of air brakes, is as wearing on the body and nerves of the traveler as it is on the car and the travels.

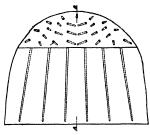
When many of the railroads were first built, high explosive seephosives were expensive and uncertain. Only one or two kinds were known, and instead of being ability or to secure a different one especially adapted to almost every particular kind of rock which is encountered, as the possible to-day, it was necessary to do all kinds of other blasting with practically one kind of dynamite. Nataurally one kind of dynamite. Nataurally the second of the probability. This was one of the reasons why, unlated of tunneling through the monutain as is done today, the railroads wound tortously over a resum.

In railroad building and the railroad shortening now done, tunnels are bored for miles through the mountains much nearer to their base, great open cuts are made through the bills, one-third or one-half way up their sides, and the rock and earth taken out is used to fill up to approximately the same level a now abel across the adjoining valleys. Instead of oruring all the way around the spurs of mountains and of hills, railroad builders cut them partly away.

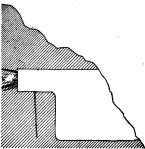
nins, rairoan ouncers cut unemparity away not no None of this boring and sileing through rock can be done economically without dynamite. It would take twenty-five to thirty carloads of dynamite to blast a double track railroad tunnel, a mile long. Much less dynamite is required for the same yard-ase in onen work.

Rallroads and all other tunnels more than at zo elasti feet high are driven in two sevilons, one above the other. The upper section, called the heading, is started first and always kept a number of yards in advance of the lower section or "bench." This practically divides the tunnel into a smaller tunnel, six or eight feet high, and as wide as the upper part of the main tunnel, and a "thorough cut" represented by the "bench" It is more economical and convenient to drive a tunnel in this way than it would be to attempt to carry forward the entire face at once. In

the first place it provides a solid foundation and footing for the drills and men boring the holes for the explosives in the upper part. Again, by taking out the upper section first, two free faces are provided when blasting the lower part, and less explosives are required when two faces are open than when only one is exposed as in the heading.



Face of heading and bench, showing position of bere holes for dynamits.



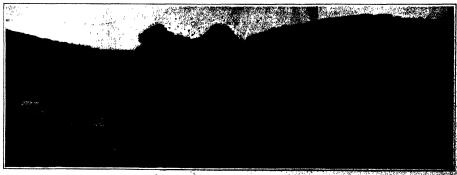
Longitudinal section through railroad tunnel, showing

The holes in the heading for the explosives are usually drilled six or seven feet deep and each is charged with from three to six pounds of blasting gelatin (100 per cent) and 60 per cent; and 60 per cent gelatin drynamits. First a wedge shaped section gelatin drynamits. First a wedge shaped section get-ending from the bottom to near the top is blasted out, two vertical rows of holes being drilled for the purpose. These holes, which are called the "cut"

holes, are several fact spart, at the macies, but were until they almost meet at the points. Seen two or four more rows are drilled outsides of them; which serve to widou the wedge whee they will be based. These are the relief heles. The Trough's is completed by the "safe" or "Th' holes sears the roy the safes and the 'top' holes across the top, the row of holes being started on a line following approximation and pointing slightly autward and upward. The secant number of holes required for each, reuns. If the heading is governed by the size and shape of the tunnels and the nature of the roat. The black the "hench," a row of holes is drilled straight fown into it parallel to the face and several feet beach of it, sad sometimes another row, aimset straight into the sacross the bottom. Bach of these is charged with two to four pounds of 60 or 50 per out gelatin dynamics as always used in tunnels because it does not give off objectionable frames when exploding, and is highly waterproof. Tunnels are often very wet and the ventilation is necessarily limited.

Rairroad cuts, if they are deep ones, are blasted in benches, the depth of these benches depending an the kind of drills with which the holes for the dynamite are bored. When well drills are used, the holes are generally bered forty or firly feet deep and twenty or thirty feet apart. These holes are offered hard or the seven holes are offered with several hundred pounds of dynamite, Judson powder or blasting powder, the quantity and kind of explosive being governed by the depth of the bore holes, character of the rock and other local odd weather the 40 per cent grade of low freezing dynamite is generally used unless the rock is a soft and the work so dry that blasting powder will be satisfactory. When holes are bored with ordinary rock drills, the system of blasting is much the same. The holes, however, are not often desper than twenty feet, are spaced six to ten feet apart, and are charged with a much smaller quantity of explosives. The first cut on each level, when the railread is to run through a hill, has but two free faces, the top and front, and is commonly called the "thorough cut." The arcocacing cut on each level, which are made for the purpose of widening the original cut, are known as "open" or "idle hill" cut, and having three faces free, require less explosives per yard of cut than 60 thorough cut.

It is sometimes more economical to blast away all of a short appur running across the right of way than to make a thorough out through it or to swing around it. In this case the spurs are disposed of by exploding a very large charge—ofthe several thousand pounds—of Judson powder, blasting powder or dynamits, under them. To get the dynamite into the proper position, small tunnels, often with cross headings or chambers, are driven into the spur and in these are packed the explosives. The blast in work of this kind is usually very spectacular, though it does not often make a great deal of noise or shock at any considerable distance away.



A big blast in a heavy rallway sattlent.

DYNAMITE AS A RAILBOAD BORDER

Catskill Water Supply Tunnel Below the Hudson River

How the Aqueduct Will Make an 1100-foot Dip Below the Gorge

THE construction of the reservoirs and aqueduct for bringing a daily supply of five hundred million gallons into New York from the Catalill Mountains has involved engineering work of great magnitude, and in some cases of considerable perplexity and difficulty. As it turned out, the most serious problem was encountered at the Hudson River, where the engineers had to determine upon the best method for conducting the water past that great natural obstacle.

The state of the s

Pour alternative plans were considered; first, to lay steel pipes in trenches dredged across the trivial bottom; second, to drive a tunnel through the glacial deposit in the river bottom; third, to carry the agueduct across the river upon a bridge; and alsely, to build a huge inverted siphon at a depth sufficient to bring; it entirely within the solid underlying rock. The last was the plan adopted.

To determine the depth and character of the rock,

To determine the depth and character of the rock, fifteen vertical holes were drilled from the surface of the river, and two inclined holes, of different de-

ation, were driven fromh sbore. Six of the vertical holes reached bed rock, and them the center reached an ultinate depth of 768 feet, when it had to be abandoned without reaching bed rock. This boring devel-oped the fact that the present flows in an old giacial gorge which has been filled up with deposits of silt, eand, gravel, clay and bouldof over 800 feet. Now it was realised that a deep-pressure tunnel, to be

realised that we do ep - pressure tunnel, to be perfectly reliable, must lie in a b s o l u tely sound and unfasured rock; and since it was impossible to test the rock by vertical borings made from

acove anchored in the river, the engineera determined to explore the underlying material by means of inclined borings driven from either shore. Accordingly, two sharts were sunk to a depth of between twe and three hundred feet, and from them two dismond drill borings were started, which mittenselv ressend at a depth of 1,306 feet below the surface of the river. A good rock was found at that level. To make the segmy more reliable, a second pair of helse was drilled at a jess inclination, which crossed at a depth of 900 feet below the river surface. The right was found to be perfectly existanceur, and such wifer as was freignd was listed, in section and does to well-understood geological causes.

to well-understood geological causes. 'It was therefore determined to clark the east and west sharife to a depth of from \$1.00 to 1.00 feet below givened surface, and opmose them by a turned \$1.00 feet below the state of the shariff of the white of the West Shariff in \$1.10 feet below the two shariff of the shariff of t

Hudson River at an elevation of 400 feet above mean water level. Hence the total head of water is about 1,800 feet, and the total pressure on each square foot of the tunnel is about 46½ tons, which is balanced with a wide margin of safety by the weight of the superincumbent mass of rock, silt and water.

Andibility of the Aurora

N O question in connection with the aurora polarie has been more discussed than that of the sounds said sometimes to accompany this phenomenon, and usually compared to the rustling of silk, cracking, hisning, whising, etc. A majority of the scientific observers of the aurora have never heard these sounds. Tromholt, one of the most careful students of aurora, says in his book, "Under the Rays of the Aurora Borealis":

"Without absolutely refusing to believe in the possible existence of such a sound, I fancy that there must be some accountic deception or misunderstanding the aurora, and one of the most convincing cases
the aurora, and one of the most convincing cases
the controversy was embodied in a recent letter to
the secretary of the Royal Astronomical Society of
Canada from Mrs. George Craig, who writes from
Dawson, Yukon Territory, under date of March 21st,
1911:

"About 1.30 A M, on January 26th, as Mr. Craks and I were returning home after spending an evening out, we were startled by unbiand sounds, seeminarly from above us. We were not booking for autoral displays, as the temperature was about 16 der, below zero (much too cold for induking in astronomical observation), and were seurryink home with heade bent down into our fur storm collars, and with no thought of anything except the desirability of reaching our own freedle as quickly as possibly as

"We were arrested by strange sounds, like the swishing and brushing together of particles of finelybroken glass. The sound came in great waves, passing slowly backward and forward over the auroral

arc. Sometimes the wave, with ling, would al-most seem to surround us; then it would recede so far as to be almost inaudible Then again It would come nearer, and then drop down quite near to us, and then recede again up high overhead. For the most part, howcver. the wave and forth regularly over auroral are nearest to us.

rearest to us.
"Our '50 below zero' mist
conveloped the
heavens and the
earth, but, as
far as we could
see, there were
no 'streamers'
and no 'corons';
merely two pretty, well-defined

"I may mention that we were crossing the park at the time we first heard the sounds, and

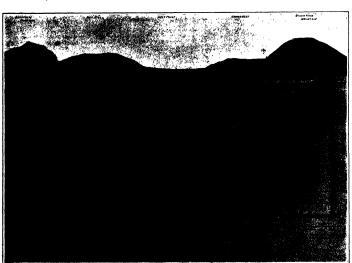
everything was as near absolute slience as could well be. 1 am told that a Mr. W H Wright, of Dawson, reported having heard the same sounds on the same morning at 3 A M"

Mrs Craig states further that during her eleven years residence in the Yukon, though she had seen many splendid displays of the aurors, she had never before heard anything approaching a sound coming even from the brightest of them.



WE all remember with what frequency in the old narratives of experiences in the South Seas reference is made to the heavy swells of the ocean, which impressed the navigators with the idea of their remoteness from land

The great size of the sea waves in high southern latitudes has been explained by the fact that south of the Cape of Good Hope and Cape Horn there is neither windward nor leeward shore, and the prevailing wind nail longitudes is westerly. Thus when a west wind springs up it finds a long westerly swell, the effect of a previous wind, still running. The new-born wind increases the steepness of this swell, and so forms majostic storm waves, which sometimes attains a length of twelve hundred feet from creat to creat. The average height attained by sea waves in feet is about half the velocity of the wind in unlies per hour.



This huge syphes, 14 feet in diameter, will carry the 500 million gallon per day water supply for New York beneath the Hudson River at a depth of 1,100 feet.

CATSKILL WATER SUPPLY TUNNEL BELOW THE HUDSON RIVER

which has created this belief in an auroral sound. During my stay at Koutokaino I was daily surrounded by people who believed as firmly in the sound as in the Holy Gospel, yes, at Boseskop they even told not think there was any surrora borealis at all until it whitered; and still I maintain that of all the intense surrors I have observed in various parts of the Arctic regions, and which I am sure I have watehod with more attention than is generally bestowed on them, every one has been perfectly silent."

These words represent the attitude of most writers on the aurors to the question of its audibility. Amost points out that the possible causes of erroneous observation are very numerous; the observer may be tampted to attribute to the aurors many sounds that have nothing to do with it, a principal one in the polar regions being the incessant crackling of fields of enow, and the faint sounds that accompany the formation of small medies of ice on clear, cold nights. On the other hand, the supposed sounds have also been explaining as subjective phenomens—the "phonisms" of the physical points of

There remains, however, much evidence to contradict these attempts to explain away the sounds of

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Illustrations and Applications of Electric Tension

THE German periodical Die Welt der Technik re-produces some very readable and cleverly li-lustrated passages from a recent book, "Entde-ckungsfahrten in den elektrischen Ozean," published by Prof A. Slaby, of Berlin, the well-known wireless telegraphy expert

The first experiment to which the author draws attention is designed to demonstrate the fact that the poles of a battery on open circuit carry charges quite similar in their action to those observable upon a material which has been rubbed to electrify it. As ingls of a secondary battery, and between them is delicately suspended a piece of fine aluminium foil The whole is covered with a glass bell to protect it The whole is covered with a gass best to protect it from air currents. Under these circumstances the aluminium foll is seen to be first attracted toward one of the disks (the one which happens to be nearest), owing to the gathering of an induced charge upon it, which is opposite in sign to that of the inducing electrode. As soon, however, as the foll touches the electrode it receives by conduction a charge of the same sign as that of the disk, and is instantly repelled, and flies to the opposite electrode, to which it gives its charge, at the same time receiving now a new charge of the opposite sign This succession of events is repeated indefinitely, the foil swinging to and fro like a pendulum. In this way the battery is very slowly discharged

The state of affairs which exists at the poles of a battery is commonly described by saying that there is a difference of potential, or an electric tension between them. For the purposes of practical applications of electricity it is necessary to have some measure of this tension. The idea naturally suggests itself to use the attractive force between the two poles to measure this tension, and this is in fact one of the methods employed to measure difference of potential. An electro meter built on this plan is shown in Fig To measure the difference of potential between 2. To measure the difference of potential observed we opinis, such as the poles of a battery, the one is connected to a fixed plate, and the other to a movable disk suspended above the first. There is thus produced an attraction between the two disks, and the amount of this may be indicated directly by a pointer, as in a letter scale, or may be determined by means

as in a letter seal, or may be determined by means of a counterpoise weight

An effect of electrostatic tension which makes itself felt in various ways is its influence upon the condensation of liquids from vapors and from small drops into larger To this action is, for instance, due In part the refreshing clearness of the air which is felt after a thunderstorm. This is not due merely to the washing down of the dust by rain, but at least in part also to the condensation of moisture upon dust nuclei, which are in this way carried to the ground. The condensing action of a field of electric tension can b shown experimentally by means of a fountain Ordinarily this presents the ap-pearance shown in Fig 3, the water fall-But on bringing ing back in a fine spray. But on bringing up for example an electrified ebonite rod the water is seen to gafher into large heads (Fig 4) It has been proposed by SIT Oliver Lodge to make use of this phenomenon for the purpose of laying the very troublesome dense fogs which periodically engulf London and other cities of England

Prof Slaby has also carried out experiments on smoke shatement, using the apparatus shown in Fig. turnentine lamp is burnt beneath a bond and the black smoke thus produced is allowed to pass up a tall stovepipe in which are placed two terminals connected to a high tension circuit. It was found that in this way every particle of the soot formed could be condensed at the bottom of the pipe. At fire sight this appears to be a most desirable achievement, for the smoke thus condensed is of course un-burnt fuel, and as such of considerable value. Unfortunately, the cost of the operation is found to be out of proportion to the values recovered. The same objection is the cause of Sir Oliver Lodge's failure to cope with the fog situation in a practical way.

It does not necessarily follow, however, that experi-ments of this kind must remain quite fruitless. For certain special purposes of industry electrical con-densation may be found practicable.

Mathematics and Medicine

I N an article with the above heading in Arms and the Man, Capt. Louis C. Duncan, Medical Corps, United States Army, says: "I believe it was stated that the death rate for operations on abdominal wounds in the Cuban war was 100 per cent. But an examination of the data showed but three such wounds, and they not operated on in the field. At any rate it should be obvious that no valuable conclusion could be drawn from so few as three cases. is stated that in our civil war there were four times as





A metal oscillates between the rminals of a battery.

Fig. 2.--- Attracted disk elecster, an is for me suring differ

my deaths from disease as from bullets; while in the Spanish war there were twelve times as many, The obvious conclusion of the average reader is that there was three times as much disease and death in the latter war as in the former. This conclusion is entirely false, the fact being that there was more than twice as much disease and deaths from disease (proportionately) in the civil war as in the Spanish war. Again, it is stated that in the Boer war the British lost twice as many men by disease as they did by bullets, while with the Japanese in the Russian war the ratio was precisely reversed. What is the conclusion? Why, that the British losses from disease were four times those of the Japanese, and reasoning still farther it is proclaimed that the Japanese sanitary arrangements must have been far superior to the British. Again, all this reasoning is fallacious and the conclusions false. The British losses were no



Fig. 8. - A fountain f water under ordinary condi-tions.



Pig. 4.—The same fountain

of an electric

greater than the Japanese. The Japanese had as much or more disease than the British. 'In a series of articles recently written by an im-

aginative gentleman (Gen. Homer Lea), and since published in book form under the title 'The Valor of Ignorance, this fallacious reasoning reaches the very height of absurdity. The statement is actually made height of absurdity. The statement is actually made in all seriousness that there were fifty-six times as many doubts from disease (proportionately) in our army in 1898 as there were in the Japanese army during the recent war with Russia. Here are the 'In the Spanish war fourteen men died of disease to one on the battlefield. In the Japanese army during the Russian war four deaths resulted bullets to one from sickness.' 'In a war between from bullets to one from sickness. In a war between Japan and the United States, should the ratio, remain the same, the American losses trained disease would be 700,000, as against 12,500 Japaness. The colorant error of this lil considered estimates should be apparent to this suit considered estimates.

ilshed in a well-known journal and the breadcast in book form, apparently mass Possibly the whole thing is considered fiction statement, reflecting in the gravest mann army, and more pointedly on the medical de of it, is put down as a fact. To show the absurdity of it let us reverse the problems, say we had one-fourteenth as many desi wounds as from disease in 1898. The Japane four times as many deaths from wounds as try case; therefore they had fifty-six times as many deaths from bullets as we, Q.E.D. And in a war between us From notifets as we, q.s.l.l. And in a war necessaries we should got off with but 18,590 killed, while this poor Japanese would lose 700,000. Riddenious, ef course; but not an lots more so than the other.

"The fallacy in both cases lies in using a variable

quantity, or, worse, two variable quantities, as a standard of comparison. Use a fixed quantitie—1,400 mes in service one year—as the standard, and this error disappears. If we use this, the only légical standard of comparison, we learn that the record in 1898, was not fifty-six times as had as that of our Oriental friends in 1904.5; it was not ten times as bad; it was not even twice as bad. The actual facts are that the American death rate from disease in 1898 was about twenty-five per 1,000 per annum, white the Japanese rate was between twenty-five and thirty Their rate was no better than ours. But that is not Their rate was no better than ours. But that is not all. In the year 1899 we had a considerable army in the Philippine Islaining that is, to say in the tropics, which had sivery Serie death traps for armine. Compared with these islands Manchuria is by all reports a health resort. Col. Harvard says it is one of the healthiest countries in the world. Yet our loss from disease in that year of campaign is reported by the surgeous generate to have been 18.30 per thousand; actually far loss; than that of the Japanese. This will be hower to these who calculate the surgeous for a mailtager. news to those who calculate the success of a sanitary

"Another grave defect of this battle-to-disease ratio is that it gives no information of the progress of the sanitary corps, whether toward better thin Col. Simpson, of the Royal Army Medical Corps, says: In McKenzie's tables and in others stress is laid on the ratio of less by disease to that from battle. This is, of course, a legitimate comparison from some aspects, but it must not be diverted from its useful purpose, and employed as a criterion of the excellence of the medical service engaged.' He proceeds to show that the disease death rate may be increasing as com-pared with the battle losses, while the actual disease

death rate computed for each thousand men is steadily declining; a state of af-fairs which actually occurred during the South African war. From 1899 to 1902 the disease death rate rose from twice the battle losses to four times their figure. By the usual fallacious reasoning the sanitary service was steadily declining in efficiency. In fact, it was steadily improv-ing and the death rate from disease de-creased from 38 per 1,000 in 1899 to 32 per 1,000 in 1902, or almost fifty per

the remedy? It is one of the simplest facts of mathematics that, in order measure two unequal quantities, a single fixed standard is necessary. No rule-of-thumb carpenter would undertake to thumb carpenter would undertake to measure two boards using a foot rule for one and a metric tape for the other, and not knowing how to reduce the meter is t. Yet, that is precisely what is done by many iters. They say the German in 1870 had three-riths as many deaths from disease as from wounds.

writers. while we, in 1881-65, had four times as minny deaths from disease as from wounds. Ask them the relation between the hattle losses and they do not know in an other times and the second of the second not even think it important. They are measuring by two standards.

two standards.

The idea of comparing disease, with battles it some years ago, when the world, and mere especial the taxpayer, was not completed of the escessity organized medical departments for armines. In the convince the reluction transpares, and these years executives of the measurity for a seminary constitution of the measurity for a seminary constitution of the measurity for a seminary constitution. solutions of the ancessity for a sunface, con-proper rain and pay the agreement that thesess more deaths, than wounds, was presented. It do affectly some surprises to the con-vary boar founds measurer. Complete rain of grapped the agreement pair, particular part, of discuss and later to growing in. The contents



finantity used, but since then it has been, one says, "diversed" and personned to the supering the efficiency of the sanitary seres, and it must be said that the tables in vortes on military hygiene lend themselves h a perversion. It is against this per ss, confusion and with its resulting be we errors, that I protest. The number of deaths e in each th cousand men for each year o the east should be actually computed; The length of war and the average number of men in the field ere very important factors. Then the number of depths and the efficiency of sanitary measures in the army may be fairly compared with those of another, e or another war. To be sure, there will be some small place for error, nothing human is perfect, but the ratio will be a very close approximation. If the data are worked out by months, it may be determined. as a war progresses, whether the sanitary corps is improving the situation or not. The number of sthe per thousand per annum is the only standard for measuring the efficiency of the sanitary corps of an army, using deaths as a basis. Deaths from lets have nathing to do with the problem. To introem only leads to confusion and error.

"Deaths from disease, per thousand, per annum: British army in India, 1832 to 1852, 69; French army, Crimean war, 121; British army, Crimean war, 93; Crifficean war, 121; Britian army, Urimean war, 193; Unifed States army, war with Mexico, 110; Union armay, civil war, 53; German army, Franco-Prussian war, 18.8; United States army, Spanish war, 25; Brit-ish army, Bouth African war, 24; Japanese army, Russo-Japanese war, 25-30; Russian army, Russo-Japanese war, 25; United States arms; Philippines, 1899. 15.8. The death rate for the Russo-Japanes war has not as yet been accurately determined. war nas not as yet own accurately determined. The bumber of deaths from disease in the Japanese army was 27,500, the time one and two-thirds years; the average number of troops could hardly have exceeded 500,000. This gives the death rate of thirty per

thousand per onnum "

The Speaking Dog "Don"

OR several months a dog named "Don," which, acrding to newspaper report, actually speaks or articulates words, has been exhibited in Germany. Prochnow, in a recent issue of Itie Umachau, gives an analysis of the dog's performance and dispels most the glamor that has surrounded it. He finds that the dog, in reply to questions, barks a response which can be interpreted as "hunger," "ruhe" or "kuchen," indicating that he is hungry, sleepy or wants a bis on seldom answers promptly and and evidently does not understand the meaning of the ons. He does not even utter his own nam rectiv, as he cannot press his long tongue firmly against his teeth to produce the true sound The vowel sound is likewise imperfect, so that the name, as the dog pronounces it, sounds as much like "Wow" as like "Don." To the question "Was much like "wow as like "Don." To the question "was hast du?" Don. responded with barks, some of which suggested the word "hunger." The word "haben" was "spoken" almost as a monosyllable and with very ladistinct vowels, so that it differed little from "Don" The words "kuchen" and "ruhe" were also very much alike, as the "ch," "h," and "n" were very indistinct and the initial consonants were almost imperceptible. The indistinctness of the "r" is surprising, as many produce this sound involuntarily

In Dr. Prochnow's opinion, Don differs from other doms only by a more highly developed imitative faculty by the ability to produce several peculiar com binations of sounds which suggest spoken words. shows no evidence of extraordinary mental abili and often answers incorrectly. He apparently does not know the meaning of the questions which are addressed to him. These questions are usually pro proceed to num. Treese quescions are usually pro-pounded in a regular order, and the dog responds with the corresponding series of answers. That the deg unce voluntarily uttered the sentence, "Don hunger haben" ("Don is hungry"), as has been as-serted, is extremely improbable. The psychical probeersar, is extremely improbable. The psychical prob-iem of the speaking dog is similar to that of "wise Hasis," the educated horse which attracted so much attention a few years ago. Don has also been trained

attention a few years ago. Don has also been trained by the numerous public performances. It not otherwise, and his expects are situated by haveries morella. Makes learned to observe cleanly. Don has learned to upleat his stock of "words."
This principal factor in these performances is supplied by the hearner. Associate verybody who hears the specialize deep already known the questions and ampress, which are prefetted as a circular which is distributed among the sublances. Honce this suddier other hands are prefetted as a circular which is distributed and all the substances. Honce this suddier other hands in the deep here there were that another other hands in the deep here there were that another other hands and the substances. Honce this suddier designed and alternative his substances.

of the audience, the young lady who exhibits the dog usually finds it necessary to interpret his replies.

The Design of Lightning Conductors and the Fundamental Principles Involved Therein

OUR ideas as to the mode of action and cons quently as to the proper design of lightning cone changed materially within the last few decades. This subject is discussed by Prof. Slaby in the article referred to on page 622. The virtues of the old-fashioned rod with gold or platinum points are



A double loop is made part of an ele ing (Fig. 1). tric circuit. The one limb of the loop is formed into a U and made of wire of comparatively low resist The other limb is straight, and includes an electric lamp, whose filament, of course, represent a rather high resistance. If now the terminals of a rather night resistance. It now the terminate of this loop are connected to a source of direct cur-rent of suitable strength, by far the greater por-tion of the current goes through the wire loop, and the lamp remains dark, the current through it being too insignificant to raise the filament to candescence. If on the other hand a very high fresency alternating current is applied to nais, we now find that the lamp lights up brightly. The reason for this is to be found in the shape of the conductors, and is commonly expressed by saving that a ductors, and is commonly expressed by saying that a loop of wire has a higher self-induction or a greater impedance than a straight wire. The effect of a self-induction is felt only while the strength of current is changing. For this reason it is of practically no consequence when working with direct current, but its importance is felt as soon as we have to deal with ernating currents, in which, of course, the strength

of current changes from moment to moment. Thus

trated in the accompanying draw-

if a lightning conductor is bent into a loop at any portion of its rourse, it may occur that the discharge has less difficulty in almply leaping across the loop through any intervening material than in following the ductor" slong the

Another point to be remem-bered in the design of lightning conductors is that for currents of



Fig. 9. -The Effe! Tower in a the storm. The extensive ironwork of structure presents an excellent pe-for the lightning discharge.

high frequency, such as a lightning discharge, it is practi-cally only the surface of the conductor which is effective. For this reason a hollow pipe proves quite as useful as would a thick rod of the same external shape, and a good practice is to establish electric connections between all the gutters and other metal work of a building, as these, with their large surface, form an excellent conductor for high frequency discharges. Anothey feature which has been found to require more careful attention than was formerly bestowed upon it is the earthing connection. It used to be thought that merely burying the earthing plate aufficiently deeply to insure contact with the under-ground water wise a sufficient precaution. What is needed in to said the point of earthing a

very large electric capacity is provided sufficient to fully insure that this point is made a loop for the oscillating discharge It is not enough to merely provide a terminal plate of several square vards area. best arrangement is a star of long radial wires, such as are now used for the earthing of wireless telegraphy systems It is of interest in this connection to note the magnitude of the earthing arrangement at the great wireless station at Nauen. The total length of wire builed here is no less than 33% miles, arranged in 324 radial spokes buried 82 feet deep in the ground Probably the best grounding for lightning conductor is the system of gas and water mains, and the best form for the lightning conductor itself is that of a metal cage, constituted by the metal parts on the surface of the building which have been properly joined together

Why is Europe in Advance of America in Pioneer Inventions?

66 F VERYBODY is familiar with the claim that C American inventors, engineers and manufac-turors lead the world," says Engineering News "A vast amount of boasting has been done about American ingenuity and originality and enterprise claim were well founded, it would be indeed matter for national pride, and a quarter century or more ago such a claim had a good deal to justify it. There are a number of fields of invention and manufacture in which the pioneer work was done by Americans and in which the statistics of exports still testify to our high standing

continues the Engineering News, "when one views the whole field of engineering and industry. and particularly the progress of the past twenty-five years, it is rather humiliating to contess that instead of being in the lead, the United States are lagging far in the rear

"Take for example the advances made in iron and steel metallurgy during the past twenty-five years Some original contributions have been made to the art by American inventors in that time, of course: but the great advances which have been made have almost all originated abroad. We are to-day something like five years behind Germany in iron and steel metallurgy, and such innovations as are being introduced by our iron and steel manufacturers are most of them merely following the lead set by foreigners years ago

We do not believe this is because American engineers are any less ingenious or original than those of Europe, though they may indeed be deficient in training and scientific education compared with training and scientific curvature. Consider the hand rease is the wholesale consolidation which has taken place in American industry. A huge organization is too clumsy to take up the development of an original idea. With the market closely controlled and profits and the consolidation attached methods, those who assured by following standard methods, those who control our trusts do not want the bother of developing anything new"

The Engineering News states that it instances metallurgy only by way of illustration. There are plenty of other fields of industry where exactly the There are same condition exists Americans are building the same marchines and using the same methods as a dozen years ago, and the real advances in the art are being made by European inventors and manufacturers.

"Those 'effete nations of Europe' actually appear to take a certain pride in doing new things that are worth while Original work by engineers and designers is encouraged and rewarded. In some cases American manufacturers take up these foreign inven-tions after they have been developed on the other side of the water, and after four or five years the new improvement begins to be introduced here. In American has enterprise enough to introduce here what has been proved to be excellent on the other side of the ocean

"It would be easy to cite fifty or a hundred important inventions of the past quarter century which have originated in Europe

"A notable illustration of this lack of originality in present-day American industry is the develop-ment of the internal combustion engine. There is no doubt that the application of this type of prime mover to a wide range of uses has been the most important development in mechanical engineering of the past twenty-five years; but the original work in this field has almost all been done abroad We have merely copied the European inventions Of course, there are some few meritorious details of design which have been worked out by Americans, but nearly all the really notable advances in the field of gas and oil engines from the beginning have been made in Europe."

Learning How to Fly

Hints from a Professional Aviator

By Antony H. Jannus

COMMON sense, mechanical ability, patience, good nerves and good eyesight are indispensable personal attributes of the man who wants to fly. To be sure, the same personal qualities are demanded of automobile driver and the yachtsman, but on the ground that their necessity is not nearly so great as in the air Ail things considered, the yachtsman will prove the aptest pupil in the air; for the hanof a boat is not unlike that of the handling of an aeroplane. Analogies, however, are dangerous, when it comes to the art of flying. Above all, the faculty of concentration, so essential in most sports, is absoitely essential in aviation.

Before we can learn to fly, we must have a safe

and well-constructed machine How the qualities of a machine may be determined varies with the circum-The heat method is to employ a skilled aviator to drive the machine around a circular course Where that is impossible, other considerations must guide the novice. Since the machine must stand the shock of alighting, and must ride through mud with impunity, it must tained whether or not it can stand abuse on the ground. A strong running gear is essential; for the shock of alighting on rough ground must not so weaken the machine that a fracture may later velop in the air

r the novice has assured himself that the machine is strong and that it will hold together, let him compare its controls with those of machines of ac cepted type Although radical departures may be good, they should be viewed with suspicion, and be accepted only after mature deliberation. The men who have been flying ever since the aeroplane became a practical machine have found that the pre types of control are the most efficient; and their judgment should not be lightly disregarded.

Determining the Position of the Center of Gravity.

Before even ground work is attempted, the position of the center of gravity should be determined, in the manner shown in Figs. 1, 2, 3, and 4. At what point must the machine be suspended, so that it can tip only frontward and backward and be evenly bal anced? That question must be answered in order to ascertain the possibility of the machine's pitching forward whenever mud, grass or rough ground is en-countered in alighting. If the center of gravity should lie in front of the axies of the wheels, in a machine of the Farman type, trouble is sure to fol-low Always consider the relation of the center of gravity to the wheels, in order that you may gain some idea of the distribution of the weight on the running gear when the machine is tipped forward ten degrees If the wheels are not forward far enough, there will be trouble in running along the ground. The elevators must correct whatever variance there may be from correct center of gravity and position of the wheels, and the manipulation of the elevators for that purpose requires skill If the tail is very heavy, the elevator may not be able to counteract the

The position of the center of gravity of a machine in regard to lateral stability in flight is a matter of far greater importance than untried aviators realize A center of gravity that is too low is as bad as a center of gravity that is too high. In either case there is a tendency to upset. Although the dihedral angle is considered wasteful of power, it seems to do more to secure inherent stability than any other device. Devices for maintaining stability automatically are to be frowned upon in the present state of the art. The sensitive perception and quick response which come with intimate knowledge of a machine's peculiarities are at present worth more than gyroscopes and

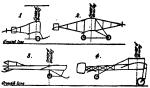
In order to acquire this infimate knowledge, the aviator must familiarize himself thoroughly with his machine He must become so accustomed to the controls that he and the machine are literally one A practised blcycle rider does not have to think about his balance Neither does the practised aviator Yet the aviator must ever be prepared to meet motor stoppages, unusual air disturbances and breakages A leap from the ground directly into the air without preliminary practice means certain accident, to put it mildly.

The more statement of the necessary pre-requisite of becoming familiar with the machine implies ground practice. First of all, the aviator should familiarize himself with his seat; for it is in that

place that he must judge wind effects, vibration, motor trouble and the thousand and one little creaks and hums that will ultimately mean so very much to Not until he has accustomed hims seat should the aviator try to run along the ground. When that time comes, he will find that it will first of all be necessary to learn the use of the rudder, particularly on rough ground. Hours should be speni in running up and down and around the practice field, simply for the purpose of studying the action of the rudder. The runs should be straight, so that when the time comes to leap into the air, the aviator may be sure that he is on an even keel, and flying

Ground Practice.

In order to avoid the possibility of leaving the ground in practice, the aviator should experiment



The position of the center of gravity.

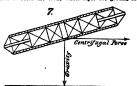
only in calm weather, and throttle down his motor so far that the speed of the machine will be reduced to ten or fifteen miles an hour. After a time, the speed can be increased to twenty miles an hour. That, however, is the maximum for ground practice. The ma-chine will leave the ground at a speed not very much greater. In these practice runs on the ground, the aviator should learn to gage the rush of air against his face. In the air, his best gage will be the wind pressure on his cheeks; for that will tell him whether he is moving on with sufficient speed to keep up or not it will also tell him ultimately whether or not



Running along the ground

he is moving along the ground fast enough to

In this stage of experimenting on the ground, the elevator is kept neutral as far as possible. With increasing skill the aviator may venture to use the elevator, but only smaringly; for it takes but very little to lift a machine from the ground with a speed of over twenty miles an hour. It will soon be speed to over (westy mines an outr. It will soon to discovered that the elevator can be used as a brake to prevent pitching forward. Tail elevators on Far-man or Blériot running gear are very effective be-cause of the blast of the propeller, even when the main planes are not moving forward at lifting spe main planes are not moving forward at fitting speed. With the Curties type of running gear and a front elevator only it is often possible at 18 or 20 miles an hour to raise the front wheel from the ground for a



The opposition of centrifugal force to gravity.

or two. These facts should indicate that at speeds of 25 or 28 miles an hour the elevator should be even more effective.

The First Flight.
The first actual flight should be confined to a sh trip parallel to the ground and not more than one or two feet above it. At first the aviator should see how close he can fly to the ground without actually

ing it, which he can do by gra That must be done calm. An appreciable am too many other factors for the avistor to master at so early a stage. This practice should be contiin calm air a foot or two from the ground, an straight flights parallel with the ground can be made with the motor wide open. If it is found that the machine barely flies straightaway with the full power of the motor, it is certain that a more powerful must be installed. In an under-engined machine, turn ing is a reckless absurdity. Moreover, the resis encountered in the air (greater than on the ground) is such that forward speed may be too lew for su tentation. Figs. 5 and 6 will show why to is nossible tentation. Figs. 5 and 6 will show why it is possible to run along the ground faster than in the sir mater certain conditions, and why the ground can be left at allow speed. If it were possible to drive a machine with such an enormous projected area as that shown in Fig. 6, a man could fly slowly for an indefinite period. But that projected area is greater than the air displaced by the propeller, and it is impossible of a contract the conference of the contract of the contr to fly except with a moderate angle of incidence.

As he increases in skill, the aviator may venture to a height of over 10 feet, a height which he must maintain as accurately as before. After making a run of 50 or 100 yards, the machine should be pointed run of 30 or 100 yards, the machine should be pointed down deliberately, but ever so slightly. The wind pressure on the face immediately becomes greater. Within a foot or two of the ground, the motor should be cut off or throttled. This should be tried ten or fitteen times, and the height increased to 30 or 40 feet, in order that the aviator should familiarise shuself with the feeling of coasting. At the end of each glide, the machine will seem to become more responsive, as indeed it does; for gliding down greatly in-creases the efficiency of the elevator and the other controls, because of the increased speed. Gliding down steep angles is often the salvation of the aviator in a tight place, particularly when his motor fails him, or a side gust threatens to upset him, or an air pocket is encountered

on sufficient confidence has been acquired at a height of 30 or 40 feet, the allerons or warping devices may be tried judiciously. Here the intention should be to correct any tendency to side tipping, and not purposely to incline the machine without actually causing a wrock. The use of the lateral control may cause the machine to swerre a little; but that may be ignored. Before landing, a straight course should always be taken, so that the machine will come down on an even keel.

on an even keel.

With increasing practice, the aviator may fly higher, but always with the understanding that there is a to the angle of incidence. An autome limit to the angle of incidence. An automobile is retarded when it travels up a short, steep fill. Bo is an aeroplane. No aeroplane has yet been made that can take a steep angle and climb straight up that angle continuously. In the air, altitudes are reached by a series of steep, even at small angles. Unless the course is straightened out at regular instruit, as makine will loss all its geped, and can no tervals, as makine will loss all its geped, and can no longer stay aloft.

Making a Turn.

The first turn should be made on a large field, and the diameter of the turn should be at least half a mile. The height should not be less than 56 feet.
After that level has been maintained for a few seconds, the rudder should be moved ever so little. The
machine will lean in almost immediately, because the outer end travels at a higher speed than the inner nd has therefore greater lift. Allerons or warping devices should be used to counteract the difference and the rudder should be swung over in the opp direction, if it should be necessary. It is obvious the if the rudder will cause the machine to bank who arrection, it it amount be necessary. It is ownross that if the rudder will cause the machine to bank when it is awaing over in one direction, it will right the machine again when swung in the opposite direction. It is even possible to turn the machine on an even of by anticipating the banking, simply by corre keel by anticipating the banking, simply by correctly using the rudder, which was necessary in the old Voisin machine flown by Farman in 1906, because it had no mechanical interior courted. The swistor should learn the correct angle of banking—in other words, the angle at which be machine will insitior; skid nor skide down-and which is most scoopenional because it requires less use of the histert origins. The necessity of "refelling the ajr "is graphed, in truthing than in any other phase, of driving the same than the contract of the state of the state of the same of the same



WO answers have been received in respi bur call for methods of reboring an engine der. One of these is published hereofth. The other selfi appear at the earliest opportunity. In the mean-time other handy men may be inspired to suggest im-proposancia on the methods here described.—Ea.

How to, Rebore an Engine Cylinder on a Common Lathe

By J. A. Bergstron

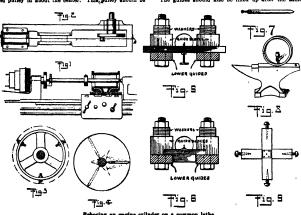
ABUMING that we have an old horizontal steam d as follows: After the cylinder has been de And the state of the engine and cleaned, it is placed on the tool carriage of the lathe with the valve seat down, blocked up approximately in center, and elamped down loosely. Oil pieces of packing rings will serve best as parallel strips for this purpose (see Fig. 1). Now take an old piece of shafting about two or three times as long as the cylinder, and fasten an old pulley in about the center. This, pulley should be

has been bored out the counterbores at each end may has been bored out the counterbores at each end may also be cut a little deeper if necessary. The cylinder is now ready to be put back on the engine bed, and it it was not "pinned on" before, it must be "lined up." owing to the play in the bolt holes. Two pieces of wood are nalled together, forming a cross say about \$\frac{1}{2}\$ inch smaller than the cylinder. In each end of the cross is inserted a round-headed wood acrew. A multi-later efficience this explicit is not sent the control of the cross is inserted a round-headed wood acrew. small piece of sinc or tin is nailed in the center and a very small role drilled therein. This arrangement is shown in Fig. 9. The cross is now placed in the forward end of the cylinder shown at A in Fig. 2 and adjusted with the wood screws until the hole in the zinc plate is in the exact center. This can be done best with an ordinary pair of hermaphrodite callpers

After the exact center is located, and the cross made tight in place, a silk cord is passed through the small hole and knotted on the outside. The other end of the cord is passed through the cylinder and fastened to a stick of wood, beyond the shaft and crank, and in the exact center thereof, and it is kept very tight The front end of the cylinder is now boited down With the gage shown in Fig. 7 locate the center of the rear end of the cylinder, as before described, using the silk cord for a center, and by moving the cylinder to one side or the other until the center is located. Then the cylinder should be bolted down tightly.

Naturally if the cylinder is worn the guides and rosshead are also. These should be filed up and crosshead are also. tested with a straight edge before they are put back on the engine. If they are worn hollow length is easier to spring them back than to file them straight, which will be explained later.

The guides should also be lined up after the same



ewhat smaller than the bore of the cylinder. The somewant smaser than the bore or the cynner. The piece of shaffing is now centered on the lattle and fastened with an ordinary lathe dog to the face plate in the usual way. In the periphery of the pulley are drilled three holes to receive the cutting tools, which, preferably, are threaded and fastened to the pulley with nuts, thereby affording adjustment to the tools. These tools are set in advance of each other so as to take cuts of different size. The last, of course, will be the finishing tool, which will be very wide and

be the finishing tool, which will be very wide and sharp, so as to give a finish to the cylinder. See Fig. 3 for the arrangement of the tools. After the spindle with its cutting head is placed on the centegs of the lattle the final "lining up" of the cylinder is to be done either by using one of the tools in the head for a guide or with any other suitable de-vice. A very simple one is shown in Fig. 7, which is seatly made and adjusted. It consists of a small stick of wood with a pin inserted in one end. The other and is made pointed. In use the end of the stick is present against the counterbore of the cylinder and the office and is moved back and forth, so that the head of the just just festibles the shaft (see Fig. 4), stewar turning the spinite so that the same apot theseen in used. When the cylinder has this been essigned and then all personally true it is to be belted down tightly and then it is ready to be bored. The code civitage is now moved to the current sight and is sed in the usual way to the left. The head of the civitage is now any to the left. The head are adjusted, his laths sighted up, sitting the head; spinit, and the barriage that take place. Care spinul to the claims are to bely out any many that members, as and see See seather. pressed against the counterbore of the cylinder and

silk cord. To do this the bottom guides are first bolted on and lined up crosswise and leveled. bolts should be drawn up "as for good" before using either level or straight edge, as the guides are likely to spring and twist either one way or the other. This may be rectified by putting a narrow strip of tin either in front, back or at the sides of the bolts, as the case may be, until they are both level and straight.

The distance between the center and the lower face The distance between the center and the lower face of the crosshead is now measured with a small gage shown at Fig. 5, having a small adjusting screw in the center. The end of the adjusting screw is set acthe center. The end of the adjusting screw is set ac-cording to the measure and the gage is placed on top lower guides at both ends. It will now be seen of the lower guides at both ends. It will now be seen that the guides are too high and should be lowered until the end of the adjusting acrew just touches the silk cord at either end of the guides. Washers of the are cut out with the hole for the boit running out to one side, so they may easily be put in or taken off.

As the guides were all right before as to level and
straightness care should be taken not to disturb these
washers, and by only adding a few whole ones it will
not change the guides in the least, only making them lower. Always tighten up the bolts every time as "for good" before any measurements are made.

After the lower guides have thus been lined up ngthwise they should also be lined up crosswise. lengthwise they should also be lined up crosswise. This may be done with a small gage made of thin wood or metal shown in Fig. 6. The gage is made of the same width as the crosshead with overlapping ends and a pointier in the center. The gage is placed at each end of the guides, which are simply knocked over to one side or the other, until the pointer comes

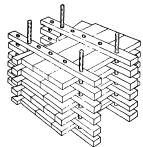
right under the silk cord. Ordinary boits somewhat lier than the holes in the guides should be used. so as to permit of moving the guides. The cord is now removed and the crosshead is placed on the lowe guides without the piston head and rod. Then one of the top guides is put on and lined up until the crosshead is free to move back and forth, without any lost motion. The guide may be sprung and twisted as before described. The other top guide is now put on and fluished up as was the first one. The holes in the guide and guide blocks should be reamed out and new boits made in order to make a good job. The piston head and rod are now connected to the crosshead with the usual key

If the cylinder has not been bored out too much the old piston rings may be used again. They can be made larger by placing them on an anvil or a block and hammering them all around the inside with a straight peen hammor, as in Fig. 8. This will spread them open and give them more life. If the cylinder has been bored out a great deal new rings will have to

A Good Glue Clamp By Charles Cloukey

THE accompanying illustration shows a very efficient clamp for use at home, in the shop or in the factory. It is made by providing as many flat pleces with the holes in as desired, and providing as many round sticks or rods as necessary to do the work desired.

The flat plees should be about % inch thick, 3½ or 4 inches wide, and 3 or 4 feet long. The holes should be 1½ inches in diameter and the rods 1% the holes should be about & inch larger than the pipe is used instead of turned rods, the holes should be about & inch larger than the pipe so that the cross pieces will slip over readily.



Handy man's glue clamp.

The holes should be bored about every 6 inches so that it will not be so much trouble to block out to the wedges in case the stock to be glued is not all of the same width

This clamp will work equally well with one board or with a stack high enough to fill the whole length of the rods. The work is put in one layer at a time of the roots. Inc. work is put none layer at a time and wedged up tightly, and then the next one, and so on until the whole setting is in. The thickness of the different layers need not be the same, and the bort-sonital bars will hold the boards from cupping up or

down no matter how tightly they are driven up.

Another advantage of this clamp is that extremely long stuff may be clamped up in the bottom of the stack and then shorter stuff added on top without taking up any extra floor space. And the most attractive feature of the device is its extreme simplicity, as it can be made by any man with the lumber and an The sticks may be made square if it is inconvenient to make them round

Fishing for Bolts By G. H. Ander

THE other day I was told to put some bolts through the floor of an electrical locomotive. The holes were sirendy drilled, but I found them to be in places where it was impossible for me to reach and put the bolts in from underneath, as they should be. The obstacles were come iron pipes containing cables for conducting the electrical cur-rent. I happened to have along some friction tape. Some of this I let down through the holes and be-tween the pipes, fished it outside the locomotive, split the tape and fastened it to the threaded end of the bolt Then I went up into the locomotive and alid the tape back through the holes, and in that way got the bolts up and the nuts secure in their places.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Principal Examiner George A. Nixon

G EORGE A NIXON is a native of the Blue Grass State, claiming Covington, Ky, as his birthplace, residing in that section as a boy and attending Chickering institute at Cincinnati, going later to Rensselaer Polytechnic Institute, and



finishing his engineering course at Le high University.

After completing his college course, he was for a number of years a member of the engineering corps of the Chicago, Milwaukee & St Paul Rajiroad, both on construction and location work in Dakota and Iowa.

He was appointed a fourth assistant examiner in the Patent Office in July. 1884, and passing through the succeeding grades, was promoted to primary exam-As assistant examiner he iner in 1901 had a large experience in the class of mechanical engineering, and his engineer ing ability has manifested itself in his conduct of such classes as printing, paper manufacturers, elevators, card pictures, and sign exhibitors, buckles, buttons and clasps and metal working. In 1909 he was transferred to and assumed charge of Division 13, metal working. This class offers a large field, covering machine tools such as lathes, planers, drill presses, gea machines, screw cutting machines, fors ing machines, and others connected with the larger manipulations of iron and The familiarity with heavy machinery gained by Examiner Nixon in ses of mechanical engineering and printing stands him in good stead s consideration of the large compli cated machines forming a part of his present class, while his experience with the less complicated devices met with in of the other classes he has examined aids him in the consideration of the simpler forms sometimes found in the classes which run generally to complicated machines.

It is always good to be able to say of a man that the more you know him the botter you like him, and this is true of Mr Nixon He has a slight reserve, not a shell, and once known is found to be a delightful companion He takes broad view of patentability when real invention is present, but has strong views on the subject, much tenacity of purpose, and is characterized by a persist in seeing to the bottom of a mat-

ter before reaching a conclusion

He is a painstaking, thorough examiner, seeking in all instances to develop facts having a bearing upon a case and applying the same with a calm judg ment and a desire to do his full duty toward all concerned. His present di vision is and always has been rate one of the important ones of the Patent Office, the advances in practically all other arts operating to magnify the im-

Cleaning with Electricity

SEVERAL authors of fiction have exercised their imagination in preparing a forecast of the civilized w is it will appear at some future date. Such writers have pictured the home of the future as equipped with a variety of labor-saving devices, which reduce housework to a mere incident. Much that has been thus prophesied in this as in other matters has come true in our own day. Perhana one of the most efficient aids to domestic operations are the variety of carpet cleaners which have een placed upon the market. Especia vacuum cleaners present great advant ges both in point of thoroughness of operation. The illustration which accompanies this article shows typical representative of this class. As is shown in the half-tone engraving and more in detail in the line drawings, the instrument consists of an electric motor driving a fan-blower, which latter cre ates the requisite blast of air to carry the dust from the floor or carpet through an outlet into a collecting bag In the front portion of the sweeper, just over the suction opening, is located a rotary brush actuated by the same motor which also drives the fan When the apparatus is in use for sweeping carpets the suc tion opening is taised somewhat from the of the floor, and the force of the draft of air drives the carpet up against the suction opening, thus producing a floor. This is shown clearly which represents a

portance of metal working machines, carpet, straightening the matted the and which are useful directly or indirectly dislodging the dirt. Owing to the pocket in the development of all arts. of air right through the fabric, so it is thoroughly pursed of all dust. The use of such a sweeper brings with it a double gain. Not only is a perfect cleansing secured -without offort in cleansing secured without effort in task of taking up the carpet and relaying it is either avoided entirely or at any

The action of the blower can be reversed, and the machine then forms a very serviceable blower, which can be used for airing confined spaces, mat-tresses, bedding, etc., or for inflating pil-The motor normally rotates 3,400 revolutions per minute.

A New Aviation Motor

Description of Novel British Acres Engine of the Two-cycle Type

S with the automobile, so with th A seroplane, the 2-cycle motor did not come into use at first; and even now it is only used in several rare instances Nevertheless, it is the coming type motor for one as well as for the other type of machine. In Germany Her. Grade, the inventor of the leading Ger man monoplane, developed and has use from the start a 4-cylinder, V-type, air cooled 2-cycle motor with success. The Gnome Company, in France, has experimented with a new type of 2-cycle motor while in America most of the flights of our amateur aviators have been made with cheap 2-cycle water-cooled motors vacant space between the carpet and the The makers of such motors for marin in Fig 2, use have quickly adapted them for a partial section plane work, and on account of their sim through the front end of the apparatus plicity and cheapness they have found At the same time the brush is passed a ready sale. In our May 28th issue of vigorously over the raised portion of the last year we described some new 2-cycle

ain, and which differs materially most of the other engines now occurs at much longer intervals.

motors, thebali

be interested in this

The accompanying fliud with

new aviation engine which has a some remarkable results in Gree

flying purposes. It is constructed on the 2-cycle principle, and has apparently succeeded in actually attaining the ideal of 2-stroke engines-double power for a given size of cylinder to that obtainable from an engine working on the Otto or i-cycle plan.

As is well known to a gas engineers, the great difficulties hith-erto found in 2-cycle engines have been those of properly clearing the exhaust gases and of preventing the from becoming ignited by the remnants of combustion of the previous charge. The effect of leaving some of the burnt gases in the cylinder is obviously to fill the space which should be occupied by the fresh charge, and hence the full power of the engine is not developed. In aeroplane practice, especially, the importance of geiting every ounce of nower out of a given weight of engine is para-mount, so that the method of expelling the exhaust gases by admitting a fresh charge is a cumbersome failure. Not only is valuable space wasted, but as some of the fresh gas is sure to escape with the exhaust, some of the fuel will be wasted, and this, again, increases the weight which the aeroplane would have to carry for a given distance of flight.

For this reason, in the N. E. C. engine, designed by Mr. G. F. Mort, an entire separation is made between the mech-anism for utilizing the charge of gas, i. e., the motor proper, and the mechan-ism for introducing and expelling the charges. The use made of the piston, apart from its function in turning the force of explosion into mechanical p ment, is that it serves as a compre in compressing the charge of the fresh gas after this has been admitted to the cylinder and before it is exploded. It also acts as its own valve m the ports which are cut in the walls of the cylinder for the admission and ex-haust of the gas are covered and uncovered by the piston in its travel. All poppet or sleeve valves are eliminated. The inlet ports are placed at one side of the cylinder and the exhaust ports at the other, and the latter are continued farther away from the end of the spile der, i. e., the exhaust port is is the inlet port in each case. T is that the piston miscreer this expension to the first ports the summer presence of the burnet gas as the sed to working stroke is aggregated, from most of this set, and otherwise the date

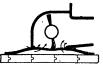


Fig. 2.—The carpet is drawn up against the suction opening, producing a space between the carpet and the floor.



ing motor, fan, brus tion opening, and outlet

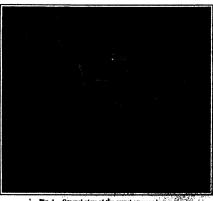


Fig. 1. - General view of the corpet sweeper in up.

in decised by Mr. Mort for aid substituting the gases for or, which forms the unique of this most interesting engine. in its simplest terms, it is a slower combined with a rotary really, hold of these being genredriven from the driving shart of the engine The Mower is divided into two parts, one deals with atmospheric air and he other with the gas for explosion.
The first thing that happens on an inlet part to a cylinder being exposed, is that siderable quantity of air without admixture of gas is blown into the cylinder. This has two effects. The first is to obviate the direct contact of a th charge of gas with the spent gases of a previous combustion which may still be flaming, and thus reduce the tempera-ture of the cylinder contents and walls the control of the co of combustion are scavenged out of the cylinder before any of the fresh charge has an opportunity of escaping.

This rotary valve takes the form of a plain orlinder revolving on ball bearings, and thus absorbing a negligible amount of power, and its function is, as stated above, to delay the ingress of resh gas into the cylinder until scavenging operations are completed. This simple device for introducing a puff of ordinary air into the cylinder has a most remarkable effect in increasing the output of a given size of engine operating on the 2-cycle grinciple, and disposing of the difficul tles which have hitherto attended the practical use of this type of engine advantages of a 2-cycle engine in producing a more uniform turning moment are evident, especially where a chain drive has to be adopted, as the flutter of the propeller, which was sometimes evident in a 4-cycle engine, is done away with The balance of the engine is improved and the power developed per pound of weight carried is far greater than in the scycle engine. A figure of three pounds per brake horse-power is one which a mr ago would have been regarded as Utopian, but neglecting the weight of lubricating oil, radiator, and cooling water, this figure is attained by the N. engine. Even allowing for these two items (and water-cooling is essential for this engine, as the cylinders are sta-tionary) the radiator, water, and oil ether do not weigh more than 70 ands for a five hours' flight, inasmuch as the engine is most economical with regard to lubricating oil, Mr. Also Ogilwie one of the well-known British avia tors, several months ago made a flight of 142 miles on a plane driven by one of ese motors with complete success, and it is pleasing to note that an engine tish manufacture bids fair to challenge the performances of aviation engines of French manufacture, such as the Gnome, which, although air cooled, owing to its revolving cylinders, has undoubt-edly a considerable consumption of lubriesting oil, thus adding to the weight to be carried. For this reason the new engine is undoubtedly one which will be studied with interest by American engi-neers on account of the new principles of

How I invented the Air Brake-II* By Goorge Westinghouse

PROGE that many persons ed or read the story of an alleged means or rean the many of an alogod therwise Newton Compander Vanderbilt and spread about the application of air season to the New New Control. The larger in todal community has a possion of larger in todal community pariets. As a

matter of fact, there is no foundation whatever for that story. From the mo-ment when the practicability of air brakes was demonstrated to the present hour there has been nothing but satisfaction and pleasure in being associated with an invention which has contributed so much to the safety and comfort of tra siers and so greatly to the prosperity of

In the development and introduction of the air brake, I was controlled by the apparent fact that the apparatus would have to be uniform upon all cars to pro vide for the convenient change of the composition of trains. It also was most obvious, in view of the crying demand for some better means for stopping trains that some power brake would inevitably be universally applied to all of the car and engines upon all railways. These ideas naturally involved a further one namely, the importance of having all of the brake apparatus made by one com pany, so as to insure absolute uniformity and consequent interchangeability, and this led to the formation of the Westinghouse Air Brake Company early in 1869 The essential parts of the air brake as first applied were:

An air-pump driven by a steam enginecciving its supply from the boiler of the locomotive.

A main reservoir on the locomotive into which air was compressed to about sixty or seventy pounds pressure per squar nch.

A pipe leading from the reservoir to a valve mechanism convenient to the

Brake cylinders for the tender and ach car

A line of pipe leading from the brake valve under the tender and all of the cars, with a pipe connection to each rake cylinder.

Flexible hose connections between th ears provided with couplings having valves which were automatically opened when the two parts of the couplings were joined and automatically closed when the couplings were separated, so that the valve of the coupling at the end of the train was always closed and prevented the escape of air when intro

duced into the brake pipe. The piston of each cylinder was at tached to the ordinary hand-brake lever in such a manner that when the pisto was thrust outward by the admission of compressed air, the brakes were applied When the engineer had occasion to stop his train, he admitted the al from the reservoir on the locomotive into the brake cylinders through the train pipe. The pistons of all cylinders were, it was then supposed, simultane ously moved to set all of the brakes with a force depending upon the amoun air admitted through the valve under the control of the engineer.

To release the brakes, the handle of the brake valve was mo ed so as to eu off communication with the reservoir and then to open a passage from the brake which had been admitted to the pipes and cylinders to escape.

The success of the apparatus upon the first train was followed by an applica-tion of an equipment to a train of six cars on the Pennsylvania Railroad, and in September, 1869, this train was placed at the disposal of the Association o Master Rechanics, representing numer ous railways, which association was then in session at Pittsburg. The train was used exclusively for controlling the speed of the train on the eastern slope of the an alleged of the train on the eastern sippe of the Vandérbitt of the desired and special stops were made that the steepest portions of the lite in such as ingreedibly short distance (as you have all thought then) as to fruitly establish in the steepest portions of the lite in such as in fruitly establish in the steepest portions of the lite in such as in fruitly established in the steepest portions of the lite in such as in fruitly established in the steepest portions of the lite in the lite used by compressed air.

Legal Notes

The Right to Use an Abandoned Trade-mark.—In Seubert, Incorporated, vs. A Santaella & Co., February 6th, 1911, the Court of Appeals of the District of Co lumbia, referring to two claimants of a trademark who were both using the mark at the time of its abandonment by the original owner thereof, savs-**1 two or more persons are using the mark at the time of abandonment, with or without knowledge of its prior use, neither would be prior to the other in point of time, since no one could in any event date priority of use beyond the time when the prior owner surrendered title by the act of abandonment"

Disclaiming Equivalents: A Novel Procooding.—In deciding the case of the Diamond Rubber Company vs. Consolidated Rubber Tire Company, the Su-preme Court said: "And a right to equivalence is disclaimed. Indeed, a certain merit is made of this, as exhibiting at once the simplicity and perfection of It appears to be a somewhat novel idea that a patentee can disclaim equivalents since it would seem that in doing so he would be disclaiming his invention. In other words, a patent without equivalents would on first thought be like "Hamlet with Hamlet left out.

An Adjudicated Patent .- The Patent Office Gazette of May 30th, 1911, reports ten adjudicated patents, two of which eld by the court to be void for lack of invention and one, a re-issue, void as granted without authority of law. The other seven patents were held valid, four of these were held to be infringed, and the other three not infringed.

An Old Device in a New Position Not An Old Device in a New Position Not Patentable.—In affirming the decree of the Circuit Court in Sleber & Russell Manufacturing Company vs. Chicago Binder and File Company, on January 10th, 1911, affecting a patent granted to Duffy, the United States Circuit Court of Appeals, Seventh Circuit, says. "Posor appears, seventh Circuit, says Tos-sibly there might have been invention in this change from one locking device to another, were the supplanting locking device itself new in the art. But it is not new in the art. It appears, precisely as the patent in suit adopts it. in the Lehy patent in the art of box fasteners. The patent in suit, therefore, has made no advance upon the previous art of loose-leaf binders, except to substitute, for the lock previously existing in those binders, a lock that previously existed in box fastenings. In our judg-ment, this transposition is not a patentable invention. As stated in the opinion of the court below, it is like putting the ordinary door lock into a new place or using a lock buckle on a saddle girth or stirrup strap, and claiming for the result a patentable combination. In the new hinder there is an old combination considerably improved, and a better result; but an old operation by old means."

A Knotty Question.—An interesting question as to patentability and infringement arose recently. For purposes illustration, we will say A has a patent for an apple parer, including a holder and a removable blade. B, by acoldent possibly finds that if he uses two blades one on top of the other, he gets superior results. It has been A's custom to soil the holder with several ment can be have any redress against A for contributory infringement. even if A suggests to a purchaser the possibility of using his construction to secure the useful results incident to B's improvement? Did B make a patentable ntion? He did not produce anything new, but simply a new use of the things already made by A, without any change whatever in the construction of the parts of A's device. At the same time, B's con-tribution to the art may be an important

RECENTLY PATENTED INVENTIONS

These columns are open to all natentees notices are inserted by special arrang with the inventors Terms on application Advartising Department of the Scinzamentas.

Pertaining to Apparel.

HAT AND CAP BAND - F. A. Kore, Minut Fla. Among the principal objects which this invention has in view are. To provide a de-vice for tightening and loosening the grip of a hat or any upon the head of the wearer, and to provide an auxiliary band for tightening the holding grip of a hat or cap upon the head of the wearer

the head of the wearer
GARMENT V M SCHMITZ, New York,
N. Y. In this Invention the Improvement relates to generate such as trousers and the
like, and has reference must particularly to
like, and has reference must particularly to
a garment which has an extendible waste pertion formed with an opening and having the
origon of the opening arranged to to become

Of Interest to Farmers.

HAY POINTS.—J W MAILTA; Chippewa Falls, Wis A fork is provided in this in state for conveniently and sutomatically landling hay, to reduce the amount of falor required in spreading the hay on the mass are required in spreading the hay on the mass at indemonated to sililed in the main stem and the mainstem when engaged by the tilp tod GRAIN METARATOR.—I P. BERDMAN, Cherokee, Okia. In this case the object is to provide a mechanism for the with suspairing the property of the provide and the state of the provide and the provided of the state of the provided of the state of the state.

PICKER ARM.—F J. BRIGHS, Gleeney, before the straw is delivered to the stack.

before the straw is deflivered to the stack,
17CKER ARM.—F J Brauss, Glencer,
Okla. An object of this inventor is to providen
a narm having a series of movable plus which
may be projected outwardly to engage the
cutton, the plus being adapted to be with
drawn into the laterior of the arm so that
the cotton may be forced off from the arm

Of General Interest.

Of General Interest.

RESTAURANT SERVICE P. KILLDEY
arck, Huron, S. D. Mona are provided in
tables automatically, and by means of which
tables automatically, and by means of which
the orders may be conveyed to the individual
tables, and the empty dishes returned to the
kithen. The device is inceptually, may be in
stailed without any changes in the room and
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statements are taken from the hook and de
libered to the customers with their concede
der the column headed "blate" designate the
days of the mouth, and the colored sheets
which divide the various series of names on
the loose leaf are for assistance to the teller
and either officers in referring to various ac-

DRAINAGE LEVEL P GUTWEIN. DRAINAGE LEVEL P Growens, Ja., Prancewille, lad The invention is a hydroxistic apparatus which includes two instruments having withhile graduations to indicate morth having withhile graduations to indicate the state of the sta

instruments are located RKCAVATOR. W. G. LAWAYSCY, Cressonal City. III. This improvement has reference more particularly to an exaction including a backet for testing material to be exacted, method in the continuous content of the exact of the content of the co

tents thereof can be discharged when the number is held flat Act January, Manustein ROPE BELLY, and The present investion relates to reper belts made from uspex of polygonal cross section the adjacent respect being seen together in the iongituiling direction at a given angle to the plane of the belt. By that is to say both the ropes forming the belt and the sewing yarm, are subjected to longitudinal steries both the ropes forming the belt and the sewing yarm, are subjected to longitudinal steries both the ropes forming the belt and the sewing yarm, are subjected to longitudinal steries both the ropes for a first and the sewing yarm, are subjected to longitudinal steries and the proposed polyming to a street, readways, trackways and the like. An object is to protted a concert-to or constitution readway to potered by a removed blocks which are interconstitution material in which the blocks are embedded.

PUMP PLUNGER. -H. MEAD, Conlings, Cal. PUMP PLUNURIC -II. Manh, Conlings, Cal. The invention has in view a tubular plunger having a jacket covering of babbitt metal so applied that portions or lugs of the metal pass into openings through the wall of the plunger had securely unite the plunger hady and jacket, yet fit with sufficient looseness to allow the eil pressure within the barrel to expand the babbitt jacket and take up part slope of the shore line which is varied by of the wear.

of the wear.

DISINFECTING CABINET.—W. C. BURGUERN, Panors, Iowa. This cablest may be measuraterused at very little express and is for use by physicians, narross, manufacturers, druggists and she bankers for disinfecting money Menn provide for introducing and removing the disinfecting gas without inconveniencing those who are in charge of the

device "ENTRIFUGAL DRIER.—J. M. Warra, Mapheno lupol, Pa. The object here is to provide a new and improved drier, more aspecially designed for drying wet sand and other wor material and arranged to permit continuous operation without damper of clogring and allow of renning the drier with comparatively little power.

he box.

HERAK GLASS PIRE ALARM.—C. ADTR.

Kew York, N. Y. Mi. Auth's investion has for
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manp.
ThPE WRITER CABINET.—Kenneris M
Braos, 62 Kest Santa Clara Street, San Jose,
Cal. This invention relates to typewriter eshinets, and the object is to provide a cabinet
adopted to partially fold. to protect the interior of the cabinet from any dust and the
like when it is not in me For this purpose



TYPEWRITES CABINET

use is made of a support provided with a removable table having receptacles and shelves, with parts of the table hinged to fold one part upon another, so that the interior will be protected from dust and the calbinet illustrated between the will be provided to the use of the table hinged and the calbinet illustrated or article of runtiluse, adapted for the use of stenographers and typewriters.

stenographers and typewifers

HOLDER FOR GRAPHOPHONE RECORDS.

—C. W ALMON, Youngstown, Ohlo. This invention is an improved holder or exhibit for disks or plates upon which graphophone records are made, and it is also adapted for holding multi-sheets and various other articles. The inacription of the atriple indicates the name of the subject of each graphophone disk, or its number, or both, as convenience may

dictate.

MUSIC LEAF TURNER-F J LATERHURO, Mins. The object of the invancier is the provision of a close and simple
device for music leaf turning, which may be
device for music leaf turning, which may be
the foot to turn a plurality of leaves in arecussion. Manus provide for permitting the
standard to be arranged at one side of the
plane, where it will not interfere with the
pricts oner

plano, where it will not interfere with the performer PHLE PROFETYOR.—C. N. HURBARD, Kamela, Ore The invention is an improve Kamela, Ore The invention is an improve the property of the water in adapted to entirely the property of the water falls and timed and has the upper portion theresholded on the property of the water falls and timed and has the upper portion therefalls of the property of th

simple, durable and efficient

WATE MOTOR—R. R. BRAKET, Ventum,
Water Motor—R. BRAKET, Ventum,
Water Motor—R. BRAKET, Ventum,
Water Motor—R. BRAKET, Water Motor—

circling of the sands.

APPARATUS FOR PREVENCING EXPLOSIONS AND DANGER FROM THE ESCAPE
OF GAS.—W. A. I VAN DE KAUP, 50 JANNEW,
Haarlen, Nethorlands. This invention has
reference to apparatus for perventing explasions and obviating the risk of poleonies by
reducing the weste of gas due to unavoidable
though unintestinals edope from pipes in
buildings and closed rooms, and for grings
processed and the first of the processed o

CENTRIFUGAL DRIER.—J. M. WHITE, warning of the accumulation of anagerous provides a new and improved drier, more sepse in unines and the like.

Provides a new and improved drier, more sepse in unines and the like.

Provides a new and improved drier, more sepse in unines and the like in the drief with the comparation of the comparation of the comparation of the comparative of the comparative

Hardware and Tools,

Hardware and Tools.

HAME FARTENER—C. G. Genacor, Versilles, Ohio. Means provide in this invention for a ready and efficient locking of the hames in tightness position and for the operation of reversing so as to riverse the hames atom of reversing so as to riverse the hames when desired. The device will be piaced on the marrier as an independent fastening device, and will be sold with the hames. I among the sold with the hames and the marrier and by its use, the hames may be secured in piace in a minimum of time.

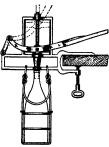
BOLT MEGRANISM FOR DOGING—S. M.

place is a minimum of time.

BOLT MECHANISM FOR DODIRA—S. N.
FRIEDMAN, New York, N. Y. In this instance
the invention relates to mechanism for securing doors and the like, and has reference more
particularly to a device of this kind provided
with locking bars, and means for projecting
and retracting the bars, the bars when projected being ailand and engaging end to end.

ROTHER MARKETINE—IN COMPANY AND THE PROPERTY OF THE

jectob being aliand and engaging and to end. ROFTLE CORKINI MACHINE-J E. ROVERT, 150 Berlin Street, Montpo-Her, VI., care of Hichard A. Horz, Barre, VI. This strong, simple machine can be manually operated with comparatively little effort; is provided with a bottle bolder obviating the necessity of positioning the bottle by means of the band, and thus doing away with the danger to the hand should the bottle brate.



BOTTLE CORKING MACHINE

while boing voted, and can be easily abmanifest to be tabled in any other satisfies any
part. In operation the moleculer circle is introduced into the guide and the plunger is
moved downward into engagement with the
cork and forces it through the guide. The
cork is compressed in passing through the
guide to that it can freely enter the bottle
cork is compressed in passing through the
guide to that it can freely enter the bottle
corrier lowest, so that the bottle can be removed and another placed in the carrier.
CONVERTIBLE COUCH AND BEED.—It,
and, how York, N. Y. In this patent the lavention has reference to household forniture,
and the onject is to provide a couch and bed,
writing of the piece of furniture from a
couch to a double bed and sies eers, and to
accommodate the bedetother when sating the
piece of furniture as a couch.
COMBINATION SHOVEL, PLOW, AND

piece of furniture as a couch.

COMBINATION RHOYEL, PLOW, AND

NUADER.—E. T. Haraw, Bait Lake City,
Utah. The object here is to protide a simple
tool capecially designed for removing snow,
which with alight cheapes may be used as
a shovel in the ordinary manner, as a scraper
to losses and scrape up the snow, as a prosper
to peak the accumulation, and as a plow to
those the snow to such also.

materials such as lard feel better, figures, reasons better and maple botter. The said intention of the present patent for the reasons better and maple botter. The said intention of the present patent is to improve the means whereby the plastic materials say to be loosened from a receptacle containing them and afforward ejected from the barrel of the said of the s

chain when releasing the grap of the pipe.
TRESTLE (LAMP.—F. P. TOROULARS, Pease
dena, Cal. The object here is to provide a
clamp very cheen and simple in construction
and operation, and one of great strength;
is fact the heavier the toed the more firmit
does the clamp hold the freetie members tograter. It may be expessed to the westlers
without danger of its end-ency becoming inplace to the contract of the

paired by rest.

WHIGHERO SCALE.—ci. M. Servanna BirURGINERO SCALE SCALE SCALE SCALE SCALE

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Bleasing and Lighting.

GAS LIGHT ATTACHMENT.—C. W. George, No. N. W. This invention portains to an attachment whereby a cluster of tains to an attachment whereby a cluster of an attachment whereby a cluster of an an individually controlled. An object is to revise a device adapted to control the flow of gas to any one of a plurality of burners arranged in a cluster, with means for simultaneously controlling the ignition of the gas STEAM (GENERATING PLANT—A. E. Drama, Carife Individually Controlling the Individual Controlling of the STEAM (GENERATING PLANT—A. E. Drama, Carife Individual Controlling of the STEAM (GENERATING PLANT—A. E. B. Drama, Carife Individual Controlling of the STEAM (GENERATING PLANT—A. E. B. HOWLINS, AND WILLIAM CONTROLLING CONDITION OF THE CONTROLLING CONTROLLING

loads.

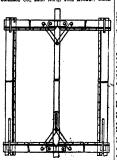
ACETILENE GAS GENERATOR—II. N
LIKES, Sabeths, Kan. The object here is to
provide improvements in generators, whereby
a continuous feeding of the curbid takes place
in proportion to the consumption of the grarested gas, and whereby as alarm is sounded
wheaver the cardid is nearly schausted, thus
to reclusing the openious delaye plants of time
to reclusing the apparatus with carbid.

Honsehold Etilities

Bloomehold USIMMes.

BHELF ATTACHENTI ION TUBE.—J M
CAMARY, Denalsen, Ohlo. The purpose of the
inventor is to provide an attachment which is
mounted upon the upper edge of a rub, and
which serves as a sope support, maintains a
wash-bord inclined at the proper angle for
service and dectually prevents wash-watein the tub from spiashing over the edge of the
tub behind the wash-board.

SELF SQUARING CURTAIN STRETCHER -JOHN O. Holmquist, care of the Holmquist wanson Co., 2438 North 40th Avenue, Chica



SELF-SQUARING CURTAIN STRETCHER.

LEGAL MOTICES

HEVENTORS are to Stanz & Co., 361 Br 645 F Street, Wantel to becuring valid puter

Patents soured.

A Free distates as to the probable bility of an investion with the readily give inventor farmishing as with a model of a brief description of the device in space communications are atrickly confidently in

Ours is the Gldest arener for section was emablished over sixty-five years at

MUNN & CO., 361 Breadway, New York Branch Office, 826 F St., Washington, S.C.

PATENTS SECURED CO. FEE Property in to Patentahility. Illiarizated fields Broke, and What To Invent. With List of Inventions with List of Inventions and Prise offered for inventions and free VDTNH J. RV AN & CO., Washington, D.D.

Classified Advertisements

BUSINESS OPPORTUNITIES

Concept clotte any borness in brones maybe speed to sell during the first in the first to be flatter, the fai and viney. Well equipped lytas (control, mailton shop and policity cross.) "see Fac. C. B. t. Day IT, See York.

18 Ho MONEY MAYITING STIGGE. "Thousands of charles and the strength of the first the strength of the first the strength of the first the strength of the streng

date (n. 1855.), Washington, 18.
Well-known passartestruck, with selling officers
throughout the fluited fitting operating at semantry
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plant, will argue to canadiarwis and emission assess
general uses mail order beautings preferred. Article
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possible and sites weekling platting insules of adjusttion and data; printhess investigate for gain or on typical
(CASPTAL, ONA). CAPITAL TO MARKET motal novelty strengy in demand, and sells to everybody at popular price; of will place on royalty. For further particulars address hax vit. Westing, New York.

WANTED.

WANTED - Designing Sugineer on light machinery and tools for weady position with well established anotherwise of the machine with the supplemental of the properties of the machine will be tent in street one sented. Communications will be tent in street one, leanes and returned if destreet. Empire.

MISCELLANEOUS

FREE—'HAVESTING PUR PROPITY Magnatine, from the year may be story you invest a dollar any property of the story on invest a dollar any property of the story of t

THE MOST FOW MR./UL LIGHT in the world. Heli-poland, Germany. Fost cards of this and meny other lighth-mass houle and foreign on sale by us. We are specialists in Lighthouse portain. Catalog free sur-where, or send a centa is stampe of any particul, and we will send if assorted cards, also outside. Lighthpuse Mission, Dept. "H. A., "El Linehald Mr. Saltest, science."

LISTS OF MANUFACTURERS. COMPLETE LISTS of menufacturers in all lines emplied as swort notice at moderate rates small gad special lists compiled in . refer at various refers times should be obtained in gavance. Address Mann & Co. 100. July liberatment, Box TR, New York.

INQUIRY COLUMN READ THIS COLUMN CARREULLY.—Too will see together for certain classes of articles bemindend in write us a close and we will seed from the write us at content and we will seed you the hamme and address of the hearty desifine the information. These is no consume to this server, as every mass it is no content of the server. In every case it is no content of the server cannot be in our content of the property of the server cannot be in the content of the server cannot be in the content of the server cannot be in the server cannot be

Inquiry No. 0:387. Wanted, information relative to the Parmelee Automatic Agrated Wester Still the first present of the property of the prope control of the contro

the "spelling and cleaning of the sections, which "P. R. R. San and D. Lastarn, Now spell, i.e., The shipet here is to provide an expensional whereby the cook on opening the is, arcetected from the heat. The device of food are being reasted with efrance to the over when the door are being reasted with efrance matches by the other than the contribution of the over when the door thrown open. This is morful when necessary to bester he article.

commy to nesse the structs.

"MENONE HANDLE HOLIPPE,—A SIMAN
Binguow, 256 W. 186h St., New York, N. Y.
Androng the principal objects which the invention shown herewith has in view are: To provision a holder which is adjustant to handle
bushes of different thicknesses, and to handles
therefore of warlows dimensions: and to pro-



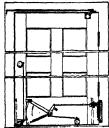
BROOM HANDLE HOLDER

vide a simple, durable and efficient construc-tion which may be quickly adjusted and when so adjusted set in fixed position with refer-ence to the handle and the brish. The handle may be constructed from any suitable patherial. The outer end of the split holder is fixed and the adder are resilient to provide for tapered ends of handles of various diameters.

Machines and Rachanteal Bevices.

A. T. Toe object of a H. R. Balary, Alany,
N. T. Toe object of a remaind to lastre a
proper inflow and outflow of the water to
present the water from accidentally passing
into the outflow and into the receptacle filled
with the beer or their liquid. The favoration
relates to hydraulic air compressors shown and
described in Latters Patura of the U. R.,
formerly granded to Mr. Balloy.

DOOR OUTBACTAN. DEVICE—CHRISTIAN
DOOR OUTBACTAN. DEVICE—CHRISTIAN
with the operating divice, the door being
closed and locked, and the cover of the deviceshown in detted lines. The device is for use
on doors of stores and other buildings, and



is arresiged to permit a person tarrying lum-due, packages or the lise, or otherwise outsimi-sered, to studied or open the door Jy pressure of the foot, and without use of the hand, to hold the door in open position for time to silver of passing convesiently through the open doorway, and to insure such closeling and locking wither passing through.

come decrewar, and to insures well closing a first possing through.

WING FOR FALLING MARTHER—We consider the property of the first possing through the property of the first possing the property of first machine, the insuring the condition of the first possing the property of first machine, the first machine.

Designation of the first possing the property of the first possing the property of t

watten provides means for leaking the con-trolling levery which means are placed in tele-ina position. The provided is the con-ting position of the control of the con-doors to the elevator shaft to prevent acci-dental rise and fail of the car while receiving passenger; to simplify the mechanism for locking the lover; and to so construct and arranges the locking mechanism as to adapt the doors are operated to swing or to slide vertically or horizontally. WELL, IBILATION IDENTICE—B. R. RANDES-MON, Orrellic, Ohlo. The alm here is to pro-vide a device of the waking beam type, in which the rapidity of oscillations of the drill scartificing its effectiveness in any particular, thereby rendering the machine capable of do-ing more work in a given time than the ord-lary drilling device.

MACHINE.—R. C. CAMPBELL.
Hartina, lowa in this patent the improvement broadly considered, comprises a disk
monared for retation, and provided with a
central opening, the dask being devised transterrely frought the ordering as and the
construction, together with the reels and the tensioning device.

Railways and Their Accessories

Rallways and Their Accessories, WHERL (GHAD.—W T. WATRON, Vas-cuaver, Canuda. This inprovement refers to wheel guards for street cars, and relates more particularly to that type of guard in which there is a feeder or erndie normally supported at a short distance above the track, but con-nected to a trip device, by means of which the fender may be lowered into operative posi-

Hon.

CAR PNNDER.-II. S. BRATTIA, Testutlan Purcha, Mex. This twention rafers to a fender which is adopted to be operated either by the motorman or automatically by impact with an obstacle or person to lower the fender into intimate contact with the ground, whereby the person to better the fender into the person or obstacle is an expensed by the person or obstacle is an expensed of posterior and deposited on the fender out of harm's way.

deposited on the fender out of harm's way.

RAILWAY HAIL AND NUTL LOCK.—Baaron Estru. 53% lat Arc. Seattle, Wash.
Among the principal objects which the preent invention has in view arc. To provide
devices to prevent the separation between
railway ties and railway ruils, and subsequently lossening and partial pulling of the



RAILWAY BAIL AND NUT LOCK

holding spikes, particularly at the rail junctions; and to provide a simple, economical and officient nut lock. The vertical cross sertion shown is of a railway rail and fish piate for securing the junction, together with the devices for preventing the separation of the rail and the

rail and the ATTOMATIC IDBAKE SETTING MECHANATTOMATIC IDBAKE SETTING MECHANISMA-14. II LOWEAL, Birchingham, Als. The
lavoration provides a mechanism coperable from
outside the cals structure to automatically set
the brakes of an engine or rain, provides
a construction wherein the automatic operation may be avoided only by wiglance on the
part of the engineer, and provides a construct
the control of the control of the
provides and provides a construct
that any selection.

Pertaining to Vehicles.

Bertalaing to Vehicles.

BIAKE BLOCK HOLDER—II. EVANS.

Ross, Wyo This improvement pertains to holders for the brisk blocks or shore of farm wagons and other whicles, and has reference more perticularly to a device, comprising a fixed jaw, a movable jaw, and common means for severing the jaws upon these beam, and and the pertain the pertains the pertain the pertain the pertain the pertain the pertains the pertain the pertain the pertain the pertain the pertain the pertain the pertains the pertain the pertains the pertain the pertains the pertain the pertains the pertai VESTICLE WIFEL, TIRE.—M. R. CAMODY.
Columbing, folio. The Investion suborduced details, that are simple, support to the columbing of the tire, and which permit a quick and convenient detachment of the extrine of the tire, and which permit a quick and convenient detachment of the extreme of the indep of the tire from the wheel rim, as well as the removator of details from the tire body it occasion requires.



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shifts of men, are run night and day. Our daily output is 2,200 automobile tires. Yet we can't keep up with our orders.

we can't keep up with our orders. It was the final in thre-making se trebled—jumped in the time that the property of the time's property of time's propert

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NEW BOOKS, ETC.

ELECTRISTAET AUS KERRICHT. Von Ett-enne de Fodor. 170 original illustra-tions. 224 pp Budapest: K. U. K. Hofbuchhandlung von Julius Benko,

1911.

THE GRAPHIC ARTS FOR PRINTERS AND Useas OF PRINTERS. ADD. Useas OF PRINTERS. Boston: National Arts Publishing Company, 1910 Price, \$2.00 per year.

The ret of printing has been much advanced by The Printing Art, which we have nolted commentation. The Compile Arts. It is a superhypoduction filled with beautiful plates and examples of printing art. Only three numbers have appeared so far, but the quality of the mugacine is well shown in these numbers. It is resulted to the compiled arts of the compiled arts. It is a superhypoduction of the printing and the printing and the compiled and the printing and the

ARRONAUTISCHE METEOROLOGIE. Von Dr. Franz Linke. I. Tell. Frankfurt a. M. Verlag von Franz Benjamin Auf-farth, 1911.

Tarth, 1911.

Dr. Linke's treatile on the above subject, the first volume of which has jost appeared, if not an epoch saking, is evitally an operation of the one of the control of the co

of spicenses for determining pressure-design (whose the vectoral motion of alreant is, her-forced) the author selected for description and (limiteration the nationoges and flexible spicent and the spicent of the spic

the limited impass to specific to the limited from the limited from the limited state of the limited from th of stringing a city out in a line sace building it above a blish-speed railway. Of coarse, it is asking a good deal to accept all this on its face, but it must at least be admitted that Mr. Chambless has provided a book which, however fantastic it may seem, prescribes about as good a cure for the disease of civ-lination as any we have encountered.

however fantatile it may seem, preseribes invoit as good a crue for the diseases of circular invoices of the control of the control of the control of the circular invoices of the circular invoices

WORLD CORPORATION. By King Camp Gillette. Boston: The New England News Company, 1910. 8vo.; 240 pp. Price, \$1.

Wonth Couronavior. By King Camp (31). Sugart to be convicting. There is a place with author returns to the subject of the breakford of the bre



(12470) A. D. W. says: Two readers wish your decisions on a coment as follows: Concerning the billity of water. A mentation the nearly incompressible. B undistants mental that continued that continued

leaguer in the water.

(13471) W. B. R. app: Will you kindly tell as it you know of any teel or appliance used for bending delicate tubing and as a good as a used in brass musical wind instruments, also for taking out dent in same! A. This metal tubes are bent without collapsing by filling them with untied wish, then bedding them the work of the collapsing the same of the collapsing the with the collapsing the same of the collapsing the collapsing the collapsing the collapsing of the collapsing the collapsing the collapsing of the collapsin

In one continuous morement.

(12472) B. J. asks: Will you please
stellar why, with the contribugal force of the
stribles why, with the contribugal force of the
strible revolution, removed when a present
stands at a pole, the entire force of gravity
would not cause his weight to be uncodumbled.

A. It is demonstrated in mechanics that the
contribugal force of the central reduces the
weight of a body on the equator 1/280 of what
it would if the earth were at rost, Thus, a
person weighting 260 pounds, if the sixtip were
at rest, would weigh 280 pounds on the
squarior with the central revoking two of
squarior with the central reducing the of
weight 280 pounds and the centrifucial force at rest, would weigh 368 pounds on the sequence with the earth rotating mose in 8 hours as at present. Gravity makes the hight weigh 269 pounds, and the contribugal free of the earth's rotation at the equator lightees fit pound. It would not seen difficult rectary the extra pound if the sents showed single contains, or to go to the point, where the seath of the sent pound in the sent through force is pres. One would, and higher thrings the sent thrings the sent through the sent thrings the sent through the

Which is graw was required for firing on increase. We was a second of the control Nordendeldt, who produced an extremely light and handy gut that four men succeeded in firing twenty-five rounds in a brighist. All of these guns gave a very severe shock to the gunner, and an attempt was made to prevent them from freedings at all. The next quantomake an appearance was Sir Hiram Maxim'a. on appearance was Sir Hiram Maxima. This gam was provided with a nuch impired system of mounting which did not give the gunes any shock at all, and at the French trials, Sir Hiram, with no assistants, See forty rounds in fifty seconds, making a renord that has never beer broken. The mounting of this gun was so much auperior to all others that III. has gone into use throughout the weight on synatically every forms of gun. The accessly consists in placing the trunsitions on a stationary sleeve and allowing the gun to yeal of the sleeve with a hydraulic buffer interposed between the buffer and the sleeve. All the with a hydraulic buffer interposed be-tween the buffer and the sleeve. All give appearatus for training the gun is al-tached to the piever instead of the bar-ried of the gun, thus completely elimina-ting the shock.

In 1989 Bir Hiram took up the subject of aerial navigation and after conducting

of aerial navigation and after conducting a great number of experiments and considering the problem from every possible standpoint, it appeared to him that the best form of a flying machine would be what is known to-day as an aeroplane. The machine that he developed and made was practically the same as the best machine of these of these event in it was much was practically the same as the best ma-chines of to-day except that it was much larger and was driven by a steam en-gine instead of a petrol engine. It had the fore and aft horizontal rudders the same as the Farman machine of today, and the two screw propellers rotating in opposite directions the same as the Wright machine. This machine was 105 Wright machine. This machine was 105 feet wide from the totig, and with 800 pounds of water and three men on board, it weighed 8,000 pounds. The engine power was 800 horse-power. The serves were of wood, 17 feet 11 inches in diameter, and collectively gave a screw threats of 2,200 pounds, which propelled from machine along a railway track at the threat or 2,200 pounds, which properled the machine along a railway track at the rate of forty miles an hour, giving a lift-ing effect of over 10,000 pounds. But the machine was altogether too large to the machine was altogether too large to be easily managed, and there was no room available in the neighborhood. It was, however, the first machine in the world that succeeded in lifting itself from the ground with a man on board.

At the last Paris Enthibition Sir Hirsm was given the Personal Grand Prix in Artillery. He has also received high decor-

tillery. He has also received high decor-ations from many governments. He was a director first in the Maxim Gun Com-pany, then in the Maxim Gun Com-pany, then in the Maxim Fortheriest Company, and afterward for twenty-seven, years in Vickers Sons & Maxim, Ltd., from which he realgned at the age of seventy-one. Hissaw S. Maxim.

stred, on account of several mechanical difficulties including greater triotion at the writing point. Besides, the danger of looking a record during a destructive earthquake through the stoppage of ink is much greater with the ink record than in the case of a silyus tracing on smoked paper.

amoted paper.

The paper is adjusted on the cylinder to form an endess belt, the ends being solind by leading small metal ribbons and solind by a single of the soling solind by leading small metal ribbons have in this method of johing was adopted because the obstruction presented by the metal ribbon to the stytus is hardly appreciable. The cylinder moves at the rate of about 35 inches an hour. The dram is mounted in definite working relation to a small clock. A wheel in the clock train is connected with a screw, thus giving at the proper time an endwise motion whereby the sheet is displaced so that it may be traversed as many times as desired. An entire revolution of the drum is accomplished every hour. The records are changed every day.

in the registering of seismic shocks, it is extremely important that the exact time down to the fraction of a minute be time down to the fraction of a minute be easily determinable, both for setting the time of its occurrence and determining its duration. Formerly the time was marked independently of the styles, but this method was unsatisfactory on account of the difficulty in determining the time. The state of the time that the state of the time is the state of the time is the state of the state

At the 30th second of each minute the standard time-keeping clock electrically releases the train of a secondary clock in releases the train of a secondary clock in releases the train of a secondary clock in release the train of a secondary clock in the current to seach vibrator. After exactly two seconds the secondary clock is again released and that time a strong current is sent instantly through all the recording levers to simultaneously produce time marks. As the cycle of actions is completed on the separate instruments, the stronger current is cut out and the vibration. Is again started. By this device Prof Mar vin compels the stylus to mark its own time.

time.

It was found that a constant vibration of the stylus would lessen the friction very much, so a small vibrator has
been devised which sets up sufficient
tremors to keep the stylus arm in sustained movement. The low, continuous
hum of this little contrivance is very
pleasest to the cer. pleasant to the ear,

pleasant to the ear.
The sheets of thin but strong record
paper are blackened thus: The recording cylinder, upon which a sheet has
been siready mounted, is placed upon
as iron support and exposed evenly to the
amoke of a specially constructed lamp.
The flat wick used is about 8 inches
The flat wick used is about 8 inches
still the support of the strong the strong the strong
tin a little longer than the wick and
slightly narrows is bent longitudinally slightly narrower is bent longitudinally through the middle into a U-she trough. The wick is folded through middle and inserted in the trough the free edges projecting enough to light easily. Kerosene oil is used, being ap plied to the wick from the ordinary can used by machinists. An even flame used by machinists. An even flame and an increased volume of soot is in

seven years in Vickers Sons & Maxim.

Lid., from which he resigned at Maxim.

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the short end of the stylus lever L.

Since the stylus lever cannot seven over a man such which rise loaded the fine to within a much within the width of the stylus lever L.

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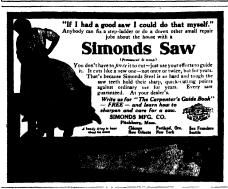
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Learning How to Fly

"the feel of the air" is acquired can : man become an expert operator. By "feel-ing the air" is meant the ability to meet ing the air" is meant the shiftly to meet any contingency intuitively. When that is acquired, safe flying is assured, and is dependent only on the integrity of the planes, controls and motor. By using the runder discreetly, and by banking simply far enough to partially offset the centrifugal force of turning, no allerons or warping wings are necessary in still air. Even too short a turn can be corrected by a quick use of the runder.

The torque of the motor renders it

by a quick use of the rudder.

The torque of the motor renders it
advisable for a novice to turn a machine
to the right, if a right-handed propeller
is used, and to the left if a left-handed
propeller is used. If two propellers are
employed turning in opposite directions,
as in the Wright machine, there is no in the wright manning, there is no inequality from the torque of the motor. Since torque is not noticeable on any machine on a straight course, recourse to machine on a straight course, recourse to straight flying will always serve the avis-tor if he finds himself in trouble on the turn. If the use of rudders and alterons has reduced the forward speed, a down-ward glide will increase it again. If the ward glide will increase it again. If the motor should stop on the turn, such a downward glide is immediately imperative. When the machine is thus gliding a change in the fore-and-aft balance be comes at once apparent, because the blas of the propeller no longer acts on the tail. It will be found that the elevator

of the properer as the class of that the elevator must then be used with greater amplitude to produce the same effect.

Before flights in other than calm air are attempted, much practice is required. The machine must be inspected over and The machine must be inspected over and over again, and the wind variations must be studied with a watchful eye. Not until this familiarity with machine and atmosphere is acquired should flying in the wind be attempted. To the man on the ground, who is simply air moving homorals. To the man in the sit of the man in the sit of the state of the draughts and vortices as well. A rising current of air lifts a machine; a down-ward current depresses it; horizontal currents affect forward speed over the ground; awirls and vortices create inequal itles in wind pressures on the planes, and disturb lateral balance. Familiarity with

all these atmospheric conditions can be acquired only with long practice. Against every tree, house, hill, fence and hedge beats an invisible surf of air. In other words, there are upward currents on one side and down draughts on the other. The upward draught is not usu ally dangerous, for it simply lifts the machine; but the down draught will cause the machine to drop. A swift down-ward glide under the full power of the motor must then be made, to increase the forward speed, and consequently the lift. That is why Chaves's flight through the Alps was so remarkable a performance.

Starting and Landing in a Wind.

A machine should always be started and landed in the teeth of a wind. An old air dog may disregard this advice, but not the novice The precaution is necessary because in landing the aviator necessary because in landing the aviator should always travel straight sheed, without the possibility of lurching, and consequently breaking a wing. Contact with the earth is necessarily made at a time when the machine is traveling over the ground at a speed of 30 or 40 miles an hour, and skidding sideways at the rate of 10 or 15 miles an hour, all direumstances which lend to wreck an aspectances which lend to wreck an aspectance which the vide a viator attempts to land the standard of the

determined spot. Aimless wandering ergr and matter is summarised.—A new hard may prove disastrous to the inea-system of perforating setted, devised by perfenced aviator. He may forget which like. Andrew Smith, is discussed.—Mr. 3. two ways the wind was blowing, or now much fuel he had, or the character of the ground beneath him. Should his motor to ground beneath him. Should his motor to grow the stop, he may make an all too heaty, de-cliffer to gravite a growing and the stop with the stop of the stop of

loss one's bearings in the after the entry because the related is completely immersed in the medical is completely increased in the medical in travels, but also because it is night as sumes a new aspect from the sect of an acreplane. Occil Orace will one of those who lost his bearings, and, as a conse-

THE STATE OF THE CONTRACTOR STATES AND THE STATES A

quence, his life.
Ordinary winds blowing over a level
country can be negotiated with comparative safety. Not lo the puffy wind. To
cope with that constant vigilinoe is required, particularly in turning. In a
circular flight in a steady wind, the only
apparent effect is that the earth is ewept
over faster in one direction than is the
other. Before a cross-country flight is
attempted, the starting field chould be
circuled at a great height. Not until then
may the long distance flight be attempted
with safety.
Cross-country flying is of counter.

ntry flying is, of course, fanating. It is a sore temptation, at an altitude of a few hundred feet, to throw all caution to the winds and to fly off over that strange country below, which is, indeed, a new land, viewed from sloft. is, inseed, a new iand, viewed from aloft. Here the greatest self-restraint must be exercised. Not until the necessary prac-tice has been acquired, not until the right kind of confidence has been gained, may one of these trips be attempted, and then only after it is properly planned.

Leicester Allen

DR. LEGICESTER ALLEN died on D June 6th, 1911, at his late residence, 5e Seventh Aranus, Broodklyn, after a lingering illness of several months. The immediate cause of death was heart disease, and the exhaustion of old ags. Dr. Allen having just passed his 79th birthday. Dr. Allen was a descendant of Col. Ettän Allen of Revolutionary fame, and was born in the central part of New York State, in Medison Country, and was educated and graduated as a dootter of medicine, but never practiced this profession, but devoted his life to scientific journalism, invention and literature. journalism, invention and literature

journalism, invention and literature. Dr. Allen was a man of considerable literary, scientific and inventive ability, and wrote a good deal for scientific and other journals. He was at one time editor of the Scientific American, and later on formed a partnership with Henry E. on formed a partnership with Henry E. Brown, patent solicitor, under the firm name of Brown & Allen, who published a mechanical and scientific paper known as the American Artison.

After Dr. Allen retired from the firm of Brown & Allen he was editor of the Solenkife Neuse, which paper was published.

Scientific Ness, which paper was pub-liabed for a short while by Salem H. Wales & Son, Mr. Wales having been one of the original publishers of the Scientific America, and which paper was finally absorbed by the Scientific American in the early eighties. Subsequently Dr. Allen devoted himself to invention and journalism, and produces some valuable inventions, one of the bes known being the Allen's dense air ice machine, which is used on board almost all of the warships in the United States and of the waranips in the Onited States for refrigerating purposes, being very effective and safe for this purpose, on account of having no dangerous fumes to deal with, as in the ammonia ma-chines, which would be unsafe aboard

ahp.
Dr. Allen was a man of high character, fine sentiments, and strong friendship, highly respected and deeply regretted by his friends.

The Current Supplement

THE International Hygiene Exposition which was opened in Dresden last month, is described in the opening article of the current Supplement, No. 1851. Planning the Flight.

It is easy to lose one's way in the air.

For that reason, it is best to follow the writes mistrainingly on the occasion will be plant be air.

For that reason, it is best to follow the writes mistrainingly on the occasion will be and of landing in some predetermined spot. Aimless wandering ergy and matter is supparationally and the part of the common spot and the part of the common spot and the com



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The | The us are apt of year eary of mercial e-rnating transformer was celebrated.

ds transformer was built by Mr. Wilham Stanley, who has presented it to the American Institute of Electrical

Fans as Fly Screens.—An enterprising business man in Mobile, Ala., has in-stalled a realing fan over the entrance stalled needing fan over the entrance to his aims to prevent files from coming in. He had found that this form of fly screen I ever effective, and does away with the achier of having a screen door for his actions to open and slam shut Heretofo: files would enter when the door was speened, and would collect in the displic windows, making it necessary to that the windows and the display objet: frequently. Now he has no such trouble other business men are adopting this simple expedient.

Moving Picture Central Station Adver-ising.—The Commonwealth Edison Com-any of chicago has adopted a novel tising.—1 pany of scheme o uany of thingo has adopted a novel ascheme of silverting the advantages of electric red king, washing, froning and cleaning. A moving picture exhibition in given a rate of the amusement parks, which shod a kitchen fitted with the sund ideal red and range and a hired girl that spens, so much fitten in attending to the roage that she cannot prepare the meal on time. The story of the usual hos—hold difficulties is told pictorially, set if ends finally in showing the contrar sfrer the husband has decided to it rid of the coal nulsance, and has stroduced selectricity in the kitchen and boundry. kitchen and laundry.

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Station at Boftsbergen.—It is it the Torrespian Government some time past a company in Japan has established the state of the Torrespian Government some time past a company in Japan has established. This will be the cante ash in constitution with Portland-term for wireless felegraphy, coment mortar. This combination is with Portland to be particularly valuable in the construction of works submerged in still witer. It is claimed that the center witer. write per some seed of the see

Draw and Undrawn Market Poultry,
—The United States Department of Agriculture has published a builetin by M
E. Pennington, on the comparative rate
of decomposition in draws and undrawn
market poultry. The conclusions are
that. (1) Undrawn poultry decomposes
more slowly than does poultry which has
been authorished by available properties. more slowly than does poultry with has been either wholly or partially eviseer sted. (2) "Fulldrawn" poultry, that is, completely eviscerated, with heads and feet removed, decomposes the most rapidly. (3) "Boston drawn" and "wire drawn" and milway between the undrawn and full drawn in speed of decommation. The "wire drawn" which is position. The "wire drawn," which is most like the undrawn, is usually the

Platinum.-Jewelers have decided that platinum is hereafter to take the place of gold as the precious metal of fashion, so cheap and common has the once precious metal of antiquity become. "What, asks an cultorial writer in the New York an cultorial writer in the New York Tribura. "Is to become of the golden wisdom of our proverbial philosophy?" In deed, the proverbial and literary consequences of the change are found more formidable than may appear at first blush "Silience," it is suggested, "may turn from golden to platinum in the speech of our descendants. But they will continue unchanged, they will continue the superior of the provided provided as politically and the superior of the provided pro

atteched of the textile materials This of Baltimore, and, and a stretched of the textile materials This tends to ni tive the static charges, reform the Johns Hopkins University with ducing the state of the static least of the product. Heretoffer degree of Ph D in 1886, receiving the tain elastic least materials and product state close in the factory windows and thus hinder; dy-williation. By the new son was appointed to his present chair method, sus manantary conditions are of scientific and historical societies and obviated or scientific and historical societies end-the author of a number of books and pam-phlets. Prof. Daniels was graduated at the University of Michigan in 1895, and became teaching fellow in Latin at the University of Missouri, where he received the degree of A.M. in 1897. In the folthe princips amprovements consists in an electrice coperated grain elevator with a copy by of a million bushels, which is so just with fifty induction which is so just a more consistent with the proper consistent which signals the least to the whortom. Here the motor fact to the whereom, Here the motor is consistent of auxiliary bushars carry. Per Duniels was called to his present in either one control of the more worked to as main bushars. When the intention being to send for a year's consistent of the consistent with the properties of the consistent with the consist



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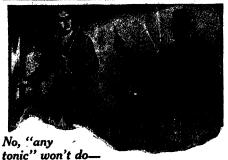


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